A Compilation of Literature Data on Standard Metabolic Rates and Swimming Costs of Pacific Salmon and Steelhead Trout (*Oncorhynchus* spp.)

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A COMPILATION OF LITERATURE DATA ON STANDARD METABOLIC RATES AND SWIMMING COSTS OF PACIFIC SALMON AND STEELHEAD TROUT (*Oncorhynchus* spp.)

by

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ABSTRACT

Trudel, M., and D.W. Welch. 2002. A compilation of literature data on standard metabolic rates and swimming costs of Pacific salmon and steelhead trout (*Oncorhynchus* spp.). Can. Data Rep. Fish. Aquat. Sci. 1090: 47 p.

In this report, we present a compilation of literature data on standard metabolic rates and swimming costs of post-larval Pacific salmon and steelhead trout (*Oncorhynchus* spp.). A total of 332 and 1,217 standard metabolic rates and swimming costs were extracted from the literature. Despite this large sample size, the experiments performed on coho salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), pink salmon (*O. gorbuscha*), and masu salmon (*O. masou*) covered only a limited range of size and/or water temperatures. No metabolic cost data were available for chum salmon (*O. keta*). In addition, despite the fact that salmon spend the majority of their life cycle in the ocean most of these experiments were performed in freshwater. Hence, further studies will be necessary to measure the metabolic rates of Pacific salmon under the full range of environmental conditions experienced by these species.

RÉSUMÉ

Trudel, M., and D.W. Welch. 2002. A compilation of literature data on standard metabolic rates and swimming costs of Pacific salmon and steelhead trout (*Oncorhynchus* spp.). Can. Data Rep. Fish. Aquat. Sci. 1090: 47 p.

Dans ce rapport, nous présentons une compilation de données tirées de la littérature sur les taux de métabolisme standard et les coûts reliés à la nage des saumons du Pacifique et de la truite arc-en-ciel (*Oncorhynchus* spp.) post-larvaires. Au total, 332 et 1 217 taux métaboliques standards et coûts de nage ont été extraits de la littérature. Malgré que le nombre de données soit élevé, les expériences réalisées sur les saumons coho (*O. kisutch*), quinnat (*O. tshawytscha*), rose (*O. gorbuscha*), et masou (*O. masou*) couvraient une gamme de masses et/ou de températures limitées. Aucuns coûts métaboliques n'étaient disponible pour le saumon kéta (*O. keta*). De plus, malgré le fait que les saumons passent la majeure partie de leur cycle de vie dans l'océan, la plupart de ces expériences ont été réalisées en eau douce. Par conséquent, des études additionnelles seront requises pour mesurer les taux métaboliques des saumons du Pacifique sous toutes les conditions environnementales rencontrées par ces espèces.

INTRODUCTION

Bioenergetic models offer a useful framework for understanding a large number of processes such as fish growth (Rice et al. 1983; Hewett and Kraft 1993), the accumulation of contaminants (Trudel and Rasmussen 2001), nutrient cycling (Kraft 1992), predator-prey and food web interactions (Stewart et al. 1981; Rand and Stewart 1998), fish migration (Rand et al. 1997; Stockwell and Johnson 1999), habitat selection (Brandt and Kirsch 1993), life-history strategies (Jensen 1998), and the establishment of stocking policies (Negus 1995).

The development and evaluation of bioenergetic models have generally been limited by the availability of the experimental data needed to estimate the numerous parameters of these models. Typically, bioenergetic models require the estimation of fish size and growth rate, water temperature, fish and prey energy density, and 10-30 parameters to model metabolic costs and waste production (Hanson et al. 1997). Because of the difficulty of performing the necessary experiments on every size class of fish to estimate these parameters, it has often been necessary to extrapolate values obtained from one life-stage to another (e.g. from juvenile to adult fish), or to borrow the parameters of another, sometimes closely related, species (Ney 1993). These practices have been severely criticized because they may introduce substantial biases in the bioenergetic model predictions, although the magnitude of these biases are largely unknown (Ney 1993). Biases in metabolic costs are particularly important to consider, as bioenergetic models are quite sensitive to errors associated with this parameter (Kitchell et al. 1977; Stewart et al. 1983).

In this data report, we present the standard metabolic rates, swimming costs, and total metabolic rates of Pacific salmon and steelhead trout (*Oncorhynchus* spp.) that we extracted from the literature to determine whether or not metabolic costs could be extrapolated between closely related species and between life-stages. The metabolic costs of sockeye salmon (*Oncorhynchus nerka*) and steelhead trout (*O. mykiss*; also known as rainbow trout) have been extensively studied (Brett 1963, 1964, 1965, Rao 1967). Empirical models of metabolic costs have been derived for these species and have frequently been applied to estimate the metabolic costs of other Pacific salmon including pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), and chinook salmon (*O. tshawytscha*) (Stewart and Ibarra 1991; Hanson et al. 1997; Davis et al. 1998; Rand and Stewart 1998).

MATERIALS AND METHODS

Standard metabolic rates (R_S; mg O_2/h) and total metabolic rates (R_T; mg O_2/h) of sockeye salmon, pink salmon, coho salmon, chinook salmon, masu salmon (*O. masou*), and steelhead trout were taken directly from tables or

extracted from published figures using a digitizer. No metabolic cost data were available for chum salmon. Whenever possible, we consulted the original source (often a thesis or government report) that was used in these articles to obtain the raw data. Swimming costs (R_a; mg O_2/h) were estimated as the difference between R_T and R_s. Fish mass, total length, water temperature, salinity, and swimming speed were noted. When total length was not reported, it was estimated using a length-weight relationship derived for each species. Fish that were reported to have signs of fatigue by the original authors were excluded from this data report, as an unknown fraction of their swimming metabolism was derived through the anaerobic pathway and was not quantified in these studies. We also excluded experiments that attached a transmitter or other device to fish, as the drag and extra load associated with these objects can significantly alter the relationship between swimming costs and swimming speed (Webb 1971).

RESULTS

A total of 332 standard metabolic rates were obtained form the literature (Table 1-10). The majority of these estimates were for steelhead trout (49.5%), followed by sockeye salmon (32.8%), and coho salmon (11.7%). One thousand two hundred and seventeen swimming costs were also obtained from the literature (Table 1-10). The majority of these estimates were for steelhead trout (53.8%), followed by coho salmon (25.6%), and sockeye salmon (12.8%).

The metabolic costs data extracted from the literature for sockeye salmon and steelhead trout covered a wide range of body sizes and temperatures (Table 11). In contrast, the experiments performed on coho, chinook, pink, and masu salmon covered only a limited range of size and/or water temperature (Table 11). For instance, oxygen consumption has been measured only on juvenile coho, chinook and masu salmon, and on adult pink salmon (Table 11). Thus, if we were to construct metabolic costs models for these species with the limited data that are currently available, it would be necessary to extrapolate them beyond the range of size and water temperature used to build these models.

As salmon spend the majority of their life cycle in the ocean, it would be important to measure their oxygen consumption in saltwater. Yet, with the exception of steelhead trout, and to some extent chinook salmon, all these experiments were performed in freshwater (Table 11). For steelhead, 60.6% of the experiments were conducted in saltwater ranging from 3.8‰ to 30.0‰ (Table 3, 7). Hence, further studies will be necessary to measure the metabolic rates of Pacific salmon under various conditions.

There is an increasing demand for developing complex bio-physical models to understand the functioning of ecosystems by integrating trophic interactions, bioenergetics, and the physical structure of the environment. The

accuracy of the predictions achieved with these models depends largely on our ability to adequately estimate the various components that are incorporated in the models. The number of parameters to estimate in these models quickly increases with the number of processes and interactions that are modeled. Unfortunately, the data required to estimate these parameters are often not available, even in well studied species like Pacific salmon. Hence, increased funding and scientific recognition of the need for basic organismal research will be critical if more realistic ecosystem models are to be achieved.

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Table 1. Standard metabolic rates of sockeye salmon. R_s: Standard metabolic rates; W: Mass; TL: Total length; T: Water temperature; S: Salinity.

W (g)	TL* (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source‡
87.9	21.5	15.0	0.0	6.9	1
36.7	16.6	5.0	0.0	1.5	2
30.3	16.5	10.0	0.0	1.7	2
32.9	16.2	10.0	0.0	2.0	2
55.2	18.8	15.0	0.0	3.9	2
62.6	19.5	20.0	0.0	7.6	2
83.8	22.4	20.0	0.0	7.2	2
52.2	18.5	24.0	0.0	10.2	2
3.4	7.7	15.0	0.0	0.8	3
8.5	10.0	15.0	0.0	0.9	3
19.1	12.8	15.0	0.0	2.4	3
55.2	18.8	15.0	0.0	3.9	3
746.0	41.8	15.0	0.0	53.0	3
1432.0	53.9	15.0	0.0	63.0	3
37.0	15.9	2.0	0.0	1.5	4
39.8	15.7	2.0	0.0	1.8	4
42.2	15.6	2.0	0.0	2.1	4
42.4	16.4	2.0	0.0	1.5	4
49.0	16.4	2.0	0.0	2.3	4
3.3	7.5	5.3	0.0	0.2	4
8.9	9.2	5.3	0.0	0.5	4
10.7	9.9	5.3	0.0	0.6	4
11.5	11.1	5.3	0.0	0.6	4
13.6	10.9	5.3	0.0	0.7	4
26.7	14.5	5.3	0.0	1.7	4
29.8	15.0	5.3	0.0	1.3	4
35.4	15.9	5.3	0.0	1.3	4
36.7	16.6	5.3	0.0	1.4	4
38.4	16.3	5.3	0.0	1.2	4
43.7	17.0	5.3	0.0	2.1	4
47.1	17.4	5.3	0.0	1.5	4
51.1	17.8	5.3	0.0	2.1	4
707.1	41.2	5.3	0.0	23.2	4
743.7	41.9	5.3	0.0	23.4	4
831.5	43.4	5.3	0.0	26.9	4
845.8	43.6	5.3	0.0	24.5	4
1130.5	47.8	5.3	0.0	36.0	4
1143.5	48.0	5.3	0.0	36.0	4
1156.4	48.2	5.3	0.0	36.0	4
1277.9	49.7	5.3	0.0	57.9	4
1299.6	50.0	5.3	0.0	37.7	4
1390.6	51.1	5.3	0.0	52.3	4
1398.5	51.2	5.3	0.0	37.3	4
1422.2	51.5	5.3	0.0	43.7	4

Table 1 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source
1446.5	51.7	5.3	0.0	49.4	4
1503.3	52.4	5.3	0.0	53.5	4
1537.7	52.8	5.3	0.0	53.5	4
1571.9	53.1	5.3	0.0	47.2	4
1634.2	53.6	5.3	0.0	55.3	4
1691.0	54.4	5.3	0.0	49.4	4
7.4	9.6	15.0	0.0	1.1	4
9.4	10.4	15.0	0.0	1.1	4
19.0	13.0	15.0	0.0	2.5	4
20.1	13.2	15.0	0.0	1.8	4
21.5	13.5	15.0	0.0	1.9	4
24.3	14.1	15.0	0.0	1.8	4
30.5	15.1	15.0	0.0	2.5	4
30.8	15.2	15.0	0.0	1.8	4
34.1	15.7	15.0	0.0	2.9	4
43.2	16.9	15.0	0.0	2.6	4
43.2	16.9	15.0	0.0	5.2	4
46.8	17.3	15.0	0.0	3.9	4
77.7	20.4	15.0	0.0	6.1	4
87.0	21.1	15.0	0.0	7.4	4
114.0	23.0	15.0	0.0	6.8	4
129.1	24.0	15.0	0.0	10.5	4
692.2	40.9	15.0	0.0	62.3	4
692.4	40.9	15.0	0.0	52.0	4
692.6	40.9	15.0	0.0	46.5	4
740.8	41.8	15.0	0.0	60.9	4
1028.0	46.4	15.0	0.0	56.3	4
1177.2	48.4	15.0	0.0	43.9	4
1177.5	48.5	15.0	0.0	43.9	4
1316.5	50.2	15.0	0.0	89.5	4
1347.3	50.6	15.0	0.0	64.5	4
1458.1	51.9	15.0	0.0	64.5	4
1595.9	53.4	15.0	0.0	67.5	4
1.1	5.6	20.0	0.0	0.2	4
1.3	5.5	20.0	0.0	0.3	4
1.4	5.9	20.0	0.0	0.3	4
6.1	9.4	20.0	0.0	0.7	4
6.3	9.0	20.0	0.0	1.0	4
6.3	9.0	20.0	0.0	0.8	4
26.3	14.4	20.0	0.0	3.7	4
33.7	15.6	20.0	0.0	4.4	4
43.7	17.0	20.0	0.0	4.1	4
57.2	18.5	20.0	0.0	7.1	4
62.6	19.0	20.0	0.0	8.6	4
74.6	20.1	20.0	0.0	8.1	4
80.7	20.6	20.0	0.0	9.7	4
84.5	20.9	20.0	0.0	7.3	4

Table 1 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source
98.8	22.0	20.0	0.0	12.8	4
787.3	42.6	20.0	0.0	68.5	4
874.7	44.1	20.0	0.0	75.0	4
951.8	45.3	20.0	0.0	81.2	4
956.9	45.4	20.0	0.0	88.9	4
1385.0	53.0	20.0	0.0	144.7	4
1530.0	57.0	20.0	0.0	112.9	4
1611.0	56.5	20.0	0.0	115.5	4
1688.0	55.3	20.0	0.0	81.4	4
1784.0	56.0	20.0	0.0	105.5	4
1794.0	59.5	20.0	0.0	118.2	4
1839.2	55.9	20.0	0.0	153.3	4
1962.0	57.0	20.0	0.0	141.6	4
2222.8	59.3	20.0	0.0	188.0	4

*Total length was determined from a length-weight relationship derived for sockeye salmon (Brett and Glass 1973) as: $\log_{10} TL = 0.707 + 0.319 \cdot \log_{10} W$

‡ Source: 1. Brett (1963); 2. Brett (1964); 3. Brett (1965); 4. Brett and Glass (1973).

Table 2. Standard metabolic rates of pink salmon. R_s: Standard metabolic rates; W: Mass; TL: Total length; T: Water temperature; S: Salinity.

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source‡
1138.0	49.5	15.0	0.0	158.2	1
1186.5	49.5	15.0	0.0	251.9	1
1292.0	50.0	15.0	0.0	188.6	1
1390.0	53.5	15.0	0.0	157.5	1
1453.0	52.0	15.0	0.0	161.0	1
1515.0	54.0	15.0	0.0	199.0	1
1533.0	54.5	15.0	0.0	192.9	1
1564.0	51.0	15.0	0.0	191.1	1
1601.0	54.0	15.0	0.0	89.3	1
1667.0	54.0	15.0	0.0	133.0	1
1823.0	57.5	15.0	0.0	138.1	1
1920.0	57.0	15.0	0.0	177.4	1
2143.0	61.0	15.0	0.0	167.8	1
2288.0	58.0	15.0	0.0	164.5	1
2333.0	57.5	15.0	0.0	160.4	1

‡ Source: 1. Milliken (1983)

Table 3. Standard metabolic rates of steelhead trout. R_s: Standard metabolic rates; W: Mass; TL: Total length; T: Water temperature; S: Salinity.

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source‡
33.0	15.1	5.0	0.0	2.5	1
34.0	15.3	5.0	0.0	2.0	1
36.0	15.7	5.0	0.0	3.1	1
38.0	16.1	5.0	0.0	2.3	1
49.0	17.8	5.0	0.0	4.2	1
54.0	18.4	5.0	0.0	3.3	1
56.0	18.6	5.0	0.0	4.2	1
62.0	19.3	5.0	0.0	3.3	1
70.0	20.1	5.0	0.0	3.7	1
71.0	20.2	5.0	0.0	4.5	1
93.0	22.0	5.0	0.0	4.7	1
97.0	22.3	5.0	0.0	6.7	1
106.0	22.9	5.0	0.0	5.9	1
110.0	23.1	5.0	0.0	6.3	1
121.0	23.8	5.0	0.0	6.1	1
125.0	24.0	5.0	0.0	7.7	1
150.0	25.2	5.0	0.0	7.7	1
1200.0	46.5	9.8	0.0	42.9	2
6.5	4.3	10.0	0.0	0.7	3
12.2	10.5	12.0	0.0	2.2	4
12.2	10.5	12.0	0.0	1.4	4
54.0	18.4	15.0	0.0	8.1	1
59.0	19.0	15.0	0.0	6.3	1
61.0	19.2	15.0	0.0	7.4	1
63.0	19.4	15.0	0.0	9.5	1
85.0	21.4	15.0	0.0	9.5	1
87.0	21.6	15.0	0.0	9.5	1
89.0	21.7	15.0	0.0	10.2	1
94.5	22.1	15.0	0.0	10.2	1
95.0	22.2	15.0	0.0	9.5	1
98.0	22.4	15.0	0.0	11.0	1
98.0	22.4	15.0	0.0	11.0	1
120.0	23.7	15.0	0.0	13.9	1
122.0	23.8	15.0	0.0	13.2	1
131.0	24.3	15.0	0.0	14.6	1
133.0	24.4	15.0	0.0	14.6	1
135.0	24.5	15.0	0.0	14.6	1
263.7	29.2	15.0	0.0	22.9	5
286.0	30.8	15.0	0.0	27.8	6
300.0	30.0	15.0	0.0	24.5	7
6.5	4.3	20.0	0.0	1.4	3
57.0	18.8	15.0	3.8	7.3	1
72.0	20.3	15.0	3.8	7.3	1
76.0	20.7	15.0	3.8	8.1	1

Table 3 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source
81.0	21.1	15.0	3.8	8.4	1
84.0	21.3	15.0	3.8	7.3	1
106.0	22.9	15.0	3.8	9.0	1
110.0	23.1	15.0	3.8	13.2	1
110.0	23.1	15.0	3.8	8.8	1
122.0	23.8	15.0	3.8	13.2	1
124.0	23.9	15.0	3.8	10.6	1
126.0	24.0	15.0	3.8	11.2	1
134.0	24.5	15.0	3.8	12.4	1
136.0	24.6	15.0	3.8	13.2	1
156.0	25.5	15.0	3.8	16.1	1
27.0	13.8	5.0	7.5	2.2	1
27.5	13.9	5.0	7.5	1.9	1
32.0	14.9	5.0	7.5	2.2	1
33.0	15.1	5.0	7.5	2.9	1
55.0	18.5	5.0	7.5	3.3	1
60.0	19.1	5.0	7.5	3.7	1
81.0	21.1	5.0	7.5	4.8	1
97.0	22.3	5.0	7.5	4.8	1
103.0	22.7	5.0	7.5	5.6	1
105.0	22.8	5.0	7.5	6.1	1
110.0	23.1	5.0	7.5	6.1	1
115.0	23.4	5.0	7.5	5.7	1
130.0	24.3	5.0	7.5	7.0	1
140.0	24.7	5.0	7.5	8.1	1
142.0	24.8	5.0	7.5	7.0	1
145.0	25.0	5.0	7.5	7.0	1
153.0	25.3	5.0	7.5	7.0	1
47.0	17.5	15.0	7.5	5.9	1
53.0	18.3	15.0	7.5	4.4	1
72.0	20.3	15.0	7.5	8.1	1
77.0	20.8	15.0	7.5	7.3	1
78.0	20.8	15.0	7.5	8.4	1
84.0	21.3	15.0	7.5	8.1	1
88.0	21.7	15.0	7.5	7.7	1
88.0	21.7	15.0	7.5	9.5	1
93.0	22.0	15.0	7.5	8.1	1
99.0	22.4	15.0	7.5	8.1	1
99.0	22.4	15.0	7.5	9.5	1
107.0	23.0	15.0	7.5	8.4	1
110.0	23.1	15.0	7.5	10.6	1
120.0	23.7	15.0	7.5	13.2	1
138.0	24.6	15.0	7.5	12.4	1
28.0	14.0	5.0	15.0	2.6	1
35.0	15.5	5.0	15.0	2.6	1
50.0	17.9	5.0	15.0	3.1	1
55.0	18.5	5.0	15.0	3.7	1

Table 3 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source
62.0	19.3	5.0	15.0	3.7	1
65.0	19.6	5.0	15.0	4.0	1
70.0	20.1	5.0	15.0	3.7	1
72.0	20.3	5.0	15.0	4.0	1
73.0	20.4	5.0	15.0	4.2	1
87.0	21.6	5.0	15.0	5.9	1
96.0	22.2	5.0	15.0	5.4	1
103.0	22.7	5.0	15.0	5.9	1
107.0	23.0	5.0	15.0	5.7	1
124.0	23.9	5.0	15.0	8.1	1
140.0	24.7	5.0	15.0	9.5	1
146.0	25.0	5.0	15.0	9.5	1
149.0	25.2	5.0	15.0	9.2	1
24.0	13.0	15.0	15.0	3.3	1
24.0	13.0	15.0	15.0	3.7	1
27.0	13.8	15.0	15.0	4.6	1
36.0	15.7	15.0	15.0	4.9	1
39.0	16.2	15.0	15.0	4.9	1
55.0	18.5	15.0	15.0	6.7	1
56.0	18.6	15.0	15.0	7.3	1
69.0	20.0	15.0	15.0	7.7	1
74.0	20.5	15.0	15.0	7.5	1
97.0	22.3	15.0	15.0	11.7	1
98.0	22.4	15.0	15.0	11.7	1
110.0	23.1	15.0	15.0	14.6	1
118.0	23.6	15.0	15.0	11.7	1
126.0	24.0	15.0	15.0	11.0	1
45.0	17.2	15.0	22.5	5.9	1
66.0	19.7	15.0	22.5	7.3	1
70.0	20.1	15.0	22.5	11.0	1
74.0	20.5	15.0	22.5	8.8	1
76.0	20.7	15.0	22.5	11.0	1
89.0	21.7	15.0	22.5	9.5	1
99.0	22.4	15.0	22.5	14.6	1
110.0	23.1	15.0	22.5	9.5	1
115.0	23.4	15.0	22.5	11.0	1
122.0	23.8	15.0	22.5	14.6	1
125.0	24.0	15.0	22.5	13.2	1
139.0	24.7	15.0	22.5	14.6	1
145.0	25.0	15.0	22.5	16.5	1
160.0	25.6	15.0	22.5	14.6	1
25.0	13.3	5.0	30.0	3.3	1
33.0	15.1	5.0	30.0	3.7	1
34.0	15.3	5.0	30.0	4.0	1
52.0	18.1	5.0	30.0	4.6	1
65.0	19.6	5.0	30.0	5.5	1
67.0	19.8	5.0	30.0	5.9	1

Table 3 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source
86.0	21.5	5.0	30.0	6.6	1
96.0	22.2	5.0	30.0	8.1	1
109.0	23.1	5.0	30.0	7.3	1
121.0	23.8	5.0	30.0	7.3	1
135.0	24.5	5.0	30.0	9.5	1
140.0	24.7	5.0	30.0	10.2	1
190.0	26.8	5.0	30.0	11.7	1
196.0	27.0	5.0	30.0	11.0	1
23.0	12.7	15.0	30.0	4.4	1
30.0	14.5	15.0	30.0	6.6	1
36.0	15.7	15.0	30.0	5.1	1
41.0	16.6	15.0	30.0	9.5	1
47.0	17.5	15.0	30.0	9.5	1
52.0	18.1	15.0	30.0	8.1	1
57.0	18.8	15.0	30.0	10.2	1
80.0	21.0	15.0	30.0	10.6	1
87.0	21.6	15.0	30.0	11.3	1
93.0	22.0	15.0	30.0	9.5	1
95.0	22.2	15.0	30.0	11.0	1
95.0	22.2	15.0	30.0	12.6	1
101.0	22.6	15.0	30.0	13.5	1
102.0	22.6	15.0	30.0	16.1	1
104.0	22.8	15.0	30.0	13.5	1
111.0	23.2	15.0	30.0	12.6	1
120.0	23.7	15.0	30.0	13.5	1
120.0	23.7	15.0	30.0	14.6	1
138.0	24.6	15.0	30.0	15.4	1

‡ Source: 1. Rao (1967); 2. Kicenuk and Jones (1977); 3. Rodgers and Beamish (1981); 4. Waiwood and Beamish (1978); 5. Webb (1971); 6. Duthie (1987); 7. Bushnell et al. (1984).

Table 4. Standard metabolic rates of coho salmon. R_s: Standard metabolic rates; W: Mass; TL: Total length; T: Water temperature; S: Salinity.

W (g)	TL (cm)	T (°C)	S (‰)	R_s (mg O_2/h)	Source‡
1.0	4.7	5.0	0.0	0.13	1
8.7	9.4	5.0	0.0	0.54	1
1.0	4.7	8.0	0.0	0.16	1
2.5	6.3	8.0	0.0	0.37	1
5.9	8.4	8.0	0.0	0.71	1
8.7	9.4	8.0	0.0	0.59	1
1.0	4.7	11.0	0.0	0.22	1
2.5	6.3	11.0	0.0	0.43	1
3.5	7.0	11.0	0.0	0.56	1
5.9	8.4	11.0	0.0	0.78	1
8.7	9.4	11.0	0.0	0.75	1
1.0	4.7	14.0	0.0	0.27	1
2.5	6.3	14.0	0.0	0.59	1
3.5	7.0	14.0	0.0	0.74	1
5.9	8.4	14.0	0.0	0.95	1
8.7	9.4	14.0	0.0	1.04	1
1.0	4.7	17.0	0.0	0.32	1
2.5	6.3	17.0	0.0	0.74	1
3.5	7.0	17.0	0.0	0.98	1
5.9	8.4	17.0	0.0	1.16	1
8.7	9.4	17.0	0.0	1.30	1
2.5	6.3	20.0	0.0	0.96	1
3.5	7.0	20.0	0.0	1.18	1
5.9	8.4	20.0	0.0	1.38	1
3.5	7.0	23.0	0.0	1.44	1
0.9	4.4	15.0	0.0	0.13	2
1.0	5.0	15.0	0.0	0.30	2
1.0	4.7	15.0	0.0	0.18	2
1.1	4.9	15.0	0.0	0.14	2
1.1	4.7	15.0	0.0	0.07	2
1.1	4.8	15.0	0.0	0.20	2
1.2	4.9	15.0	0.0	0.18	2
1.2	5.0	15.0	0.0	0.22	2
1.2	5.0	15.0	0.0	0.28	2
1.2	4.7	15.0	0.0	0.19	2
1.3	5.0	15.0	0.0	0.16	2
1.3	5.0	15.0	0.0	0.10	2
1.3	5.0	15.0	0.0	0.21	2
1.4	5.0	15.0	0.0	0.29	2

‡ Source: 1. Averett (1969); 2. Puckett (1983)

Table 5. Swimming costs and total metabolic rates of sockeye salmon. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL* (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
87.9	21.5	15.0	0.0	30.4	6.9	15.2	22.2	1
87.9	21.5	15.0	0.0	30.4	6.9	10.8	17.8	1
87.9	21.5	15.0	0.0	45.4	6.9	29.0	35.9	1
87.9	21.5	15.0	0.0	45.5	6.9	18.5	25.4	1
87.9	21.5	15.0	0.0	60.5	6.9	39.1	46.0	1
87.9	21.5	15.0	0.0	60.5	6.9	48.4	55.3	1
87.9	21.5	15.0	0.0	75.7	6.9	62.0	68.9	1
87.9	21.5	15.0	0.0	75.7	6.9	52.4	59.4	1
87.9	21.5	15.0	0.0	84.9	6.9	79.3	86.3	1
36.7	16.6	5.0	0.0	16.6	1.5	1.6	3.1	2
36.7	16.6	5.0	0.0	33.2	1.5	5.4	6.9	2
36.7	16.6	5.0	0.0	49.8	1.5	13.7	15.3	2
36.7	16.6	5.0	0.0	54.1	1.5	17.4	18.9	2
30.3	16.5	10.0	0.0	39.2	1.7	5.9	7.6	2
30.3	16.5	10.0	0.0	48.1	1.7	11.2	12.9	2
30.3	16.5	10.0	0.0	48.4	1.7	9.6	11.3	2
30.3	16.5	10.0	0.0	57.2	1.7	12.6	14.3	2
30.3	16.5	10.0	0.0	57.3	1.7	14.3	16.0	2
30.3	16.5	10.0	0.0	66.2	1.7	22.3	24.1	2
32.9	16.2	10.0	0.0	16.2	2.0	1.8	3.7	2
32.9	16.2	10.0	0.0	32.4	2.0	5.2	7.1	2
32.9	16.2	10.0	0.0	48.6	2.0	11.5	13.5	2
32.9	16.2	10.0	0.0	59.1	2.0	18.7	20.6	2
55.2	18.8	15.0	0.0	18.8	3.9	3.4	7.3	2
55.2	18.8	15.0	0.0	37.6	3.9	9.4	13.3	2
55.2	18.8	15.0	0.0	56.4	3.9	21.0	24.9	2
55.2	18.8	15.0	0.0	77.5	3.9	45.5	49.4	2
62.6	19.5	20.0	0.0	19.5	7.6	4.5	12.0	2
62.6	19.5	20.0	0.0	39.0	7.6	12.7	20.3	2
62.6	19.5	20.0	0.0	58.5	7.6	26.3	33.8	2
62.6	19.5	20.0	0.0	76.1	7.6	45.6	53.2	2
83.8	22.4	20.0	0.0	43.7	7.2	17.4	24.7	2
83.8	22.4	20.0	0.0	53.1	7.2	22.5	29.8	2
83.8	22.4	20.0	0.0	61.9	7.2	29.8	37.0	2
83.8	22.4	20.0	0.0	70.5	7.2	49.7	57.0	2
83.8	22.4	20.0	0.0	75.8	7.2	55.2	62.4	2
52.2	18.5	24.0	0.0	18.5	10.2	4.6	14.8	2
52.2	18.5	24.0	0.0	37.0	10.2	11.9	22.1	2
52.2	18.5	24.0	0.0	55.5	10.2	22.4	32.6	2
52.2	18.5	24.0	0.0	69.4	10.2	34.1	44.3	2
3.4	7.7	15.0	0.0	12.8	0.8	0.3	1.1	3
3.4	7.7	15.0	0.0	25.7	0.8	0.8	1.6	3
3.4	7.7	15.0	0.0	38.5	0.8	1.5	2.2	3

Table 5 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
3.4	7.7	15.0	0.0	51.5	0.8	2.3	3.1	3
8.5	10.0	15.0	0.0	15.0	0.9	0.6	1.6	3
8.5	10.0	15.0	0.0	30.0	0.9	1.6	2.5	3
8.5	10.0	15.0	0.0	45.0	0.9	3.4	4.4	3
8.5	10.0	15.0	0.0	59.8	0.9	6.1	7.0	3
19.1	12.8	15.0	0.0	53.2	2.4	10.9	13.4	3
55.2	18.8	15.0	0.0	19.4	3.9	3.4	7.3	3
55.2	18.8	15.0	0.0	38.7	3.9	9.9	13.8	3
55.2	18.8	15.0	0.0	58.1	3.9	22.6	26.5	3
55.2	18.8	15.0	0.0	90.7	3.9	45.5	49.4	3
746.0	41.8	15.0	0.0	31.7	53.0	41.0	94.0	3
746.0	41.8	15.0	0.0	62.7	53.0	115.6	168.6	3
746.0	41.8	15.0	0.0	94.1	53.0	252.9	305.9	3
746.0	41.8	15.0	0.0	150.0	53.0	491.6	544.6	3
1432.0	53.9	15.0	0.0	35.5	63.0	63.0	126.0	3
1432.0	53.9	15.0	0.0	71.5	63.0	189.0	252.0	3
1432.0	53.9	15.0	0.0	107.0	63.0	438.2	501.2	3
1432.0	53.9	17.0	0.0	178.0	63.0	963.7	1026.7	3
37.0	15.9	2.0	0.0	38.2	1.5	9.2	10.7	4
39.8	15.7	2.0	0.0	37.7	1.8	10.9	12.7	4
42.2	15.6	2.0	0.0	43.7	2.1	11.4	13.5	4
42.4	16.4	2.0	0.0	45.9	1.5	12.3	13.8	4
49.0	16.4	2.0	0.0	34.4	2.3	6.3	8.6	4
3.3	7.5	5.3	0.0	31.7	0.2	1.7	1.8	4
8.9	9.2	5.3	0.0	40.5	0.5	2.9	3.4	4
10.7	9.9	5.3	0.0	40.8	0.6	3.6	4.2	4
11.5	11.1	5.3	0.0	40.5	0.6	3.7	4.3	4
13.6	10.9	5.3	0.0	41.5	0.7	7.7	8.4	4
26.7	14.5	5.3	0.0	47.9	1.7	14.8	16.5	4
29.8	15.0	5.3	0.0	49.0	1.3	11.3	12.6	4
35.4	15.9	5.3	0.0	50.7	1.3	13.6	14.9	4
36.7	16.6	5.3	0.0	54.2	1.4	19.3	20.7	4
38.1	16.2	5.3	0.0	51.4	1.2	22.8	24.0	4
43.7	17.0	5.3	0.0	52.8	2.1	26.0	28.1	4
47.1	17.4	5.3	0.0	53.6	1.5	22.2	23.7	4
51.1	17.8	5.3	0.0	54.5	2.1	19.0	21.2	4
707.1	41.2	5.3	0.0	92.0	23.2	372.1	395.3	4
743.7	41.9	5.3	0.0	92.9	23.4	404.4	427.8	4
831.5	43.4	5.3	0.0	95.0	26.9	405.9	432.7	4
845.8	43.6	5.3	0.0	95.3	24.5	370.8	395.3	4
1130.5	47.8	5.3	0.0	101.0	36.0	578.2	614.2	4
1143.4	48.0	5.3	0.0	101.2	36.0	518.8	554.8	4
1143.4	48.0	5.3	0.0	101.2	36.0	506.4	542.4	4
1143.5	48.0	5.3	0.0	101.2	36.0	470.9	506.9	4
1156.4	48.2	5.3	0.0	101.4	36.0	465.2	501.2	4
1277.9	49.7	5.3	0.0	103.4	57.9	592.0	649.9	4
1299.6	50.0	5.3	0.0	103.8	37.7	995.2	1032.9	4

Table 5 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
1390.6	51.1	5.3	0.0	105.2	52.3	437.7	490.0	4
1398.5	51.2	5.3	0.0	105.3	37.3	642.7	680.0	4
1422.2	51.5	5.3	0.0	105.7	43.7	492.7	536.3	4
1446.5	51.7	5.3	0.0	106.0	49.4	446.1	495.5	4
1503.3	52.4	5.3	0.0	106.8	53.5	779.9	833.3	4
1537.7	52.8	5.3	0.0	107.3	53.5	520.5	574.0	4
1571.9	53.1	5.3	0.0	107.8	47.2	875.3	922.6	4
1634.2	53.8	5.3	0.0	108.6	55.3	1062.6	1117.9	4
1691.0	54.4	5.3	0.0	109.4	49.4	915.8	965.2	4
7.4	9.6	15.0	0.0	56.6	1.1	5.8	6.9	4
9.4	10.4	15.0	0.0	59.4	1.1	6.7	7.8	4
9.4	10.4	15.0	0.0	59.4	1.1	7.7	8.7	4
19.0	13.0	15.0	0.0	68.5	2.5	11.0	13.4	4
20.1	13.2	15.0	0.0	69.3	1.8	16.2	18.0	4
21.5	13.5	15.0	0.0	70.3	1.9	16.7	18.6	4
24.3	14.1	15.0	0.0	72.0	1.8	15.4	17.2	4
30.5	15.1	15.0	0.0	75.4	2.5	23.6	26.1	4
30.8	15.2	15.0	0.0	75.6	1.8	27.8	29.6	4
34.1	15.7	15.0	0.0	77.1	2.9	34.2	37.1	4
43.2	16.9	15.0	0.0	80.9	2.6	28.7	31.3	4
43.2	16.9	15.0	0.0	80.9	5.2	36.8	42.0	4
46.8	17.3	15.0	0.0	82.2	3.9	31.1	35.0	4
77.7	20.4	15.0	0.0	91.1	6.1	52.8	58.9	4
87.0	21.1	15.0	0.0	93.2	7.4	69.9	77.3	4
114.0	23.0	15.0	0.0	98.4	6.8	104.1	110.9	4
129.1	24.0	15.0	0.0	100.9	10.5	94.4	104.8	4
692.2	40.9	15.0	0.0	141.8	62.3	548.7	611.0	4
692.4	40.9	15.0	0.0	141.8	52.0	566.0	618.0	4
692.6	40.9	15.0	0.0	141.8	46.5	475.2	521.6	4
740.8	41.8	15.0	0.0	143.7	60.9	536.4	597.4	4
1028.0	46.4	15.0	0.0	153.6	56.3	643.5	699.8	4
1177.2	48.4	15.0	0.0	157.8	43.9	927.2	971.1	4
1177.5	48.5	15.0	0.0	157.8	43.9	748.5	792.4	4
1316.5	50.2	15.0	0.0	161.4	89.5	1127.9	1217.4	4
1347.3	50.6	15.0	0.0	162.2	64.5	1035.2	1099.7	4
1458.1	51.9	15.0	0.0	164.8	64.5	1112.3	1176.8	4
1595.9	53.4	15.0	0.0	167.9	67.5	1136.3	1203.7	4
1.1	5.6	20.0	0.0	39.7	0.2	0.7	0.9	4
1.3	5.5	20.0	0.0	45.1	0.3	0.7	1.0	4
1.4	5.9	20.0	0.0	43.1	0.3	0.9	1.2	4
6.1	9.4	20.0	0.0	64.4	0.7	4.0	4.7	4
6.3	9.0	20.0	0.0	61.9	1.0	4.5	5.5	4
6.3	9.0	20.0	0.0	61.9	0.8	4.5	5.3	4
26.3	14.4	20.0	0.0	73.2	3.7	17.0	20.7	4
33.7	15.6	20.0	0.0	76.9	4.4	23.4	27.7	4
43.7	17.0	20.0	0.0	81.1	4.1	38.1	42.2	4
57.2	18.5	20.0	0.0	85.6	7.1	40.2	47.3	4

Table 5 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
62.6	19.0	20.0	0.0	87.2	8.6	41.5	50.0	4
74.6	20.1	20.0	0.0	90.4	8.1	41.4	49.5	4
80.7	20.6	20.0	0.0	91.8	9.7	64.7	74.4	4
84.5	20.9	20.0	0.0	92.7	7.3	63.9	71.1	4
98.8	22.0	20.0	0.0	95.6	12.8	63.4	76.1	4
787.3	42.6	20.0	0.0	145.5	68.5	491.6	560.1	4
874.7	44.1	20.0	0.0	148.6	75.0	545.6	620.6	4
951.8	45.3	20.0	0.0	151.2	81.2	583.1	664.4	4
956.9	45.4	20.0	0.0	151.4	88.9	646.6	735.5	4
1385.0	53.0	20.0	0.0	127.0	144.7	1165.7	1310.4	4
1530.0	57.0	20.0	0.0	127.0	112.9	1274.2	1387.1	4
1611.0	56.5	20.0	0.0	134.0	115.5	1151.9	1267.4	4
1688.0	55.3	20.0	0.0	129.0	81.4	1076.6	1158.0	4
1688.0	55.3	20.0	0.0	129.0	81.4	1403.4	1484.8	4
1784.0	56.0	20.0	0.0	126.0	105.5	1282.3	1387.9	4
1794.0	59.5	20.0	0.0	136.0	118.2	1107.5	1225.7	4
1839.2	55.9	20.0	0.0	120.0	153.3	1366.0	1519.3	4
1962.0	61.4	20.0	0.0	128.0	141.6	1141.1	1282.8	4
2232.4	59.4	20.0	0.0	138.0	188.0	1439.1	1627.0	4

*Total length was determined from a length-weight relationship derived for sockeye salmon (Brett and Glass 1973) as: $\log_{10} TL = 0.707 + 0.319 \cdot \log_{10} W$

‡ Source: 1. Brett (1963); 2. Brett (1964); 3. Brett (1965); 4. Brett and Glass (1973)

Table 6. Swimming costs and total metabolic rates of pink salmon. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
1138.0	49.5	15.0	0.0	89.1	158.2	316.9	475.2	1
1138.0	49.5	15.0	0.0	113.9	158.2	475.2	633.4	1
1138.0	49.5	15.0	0.0	143.1	158.2	844.9	1003.1	1
1186.5	49.5	15.0	0.0	65.8	251.9	137.4	389.2	1
1186.5	49.5	15.0	0.0	86.1	251.9	183.2	435.0	1
1276.0	53.0	15.0	0.0	88.0	NA	NA	621.5	1
1276.0	53.0	15.0	0.0	108.1	NA	NA	632.0	1
1323.5	54.0	15.0	0.0	104.2	NA	NA	650.0	1
1323.5	54.0	15.0	0.0	126.9	NA	NA	826.7	1
1341.0	51.5	15.0	0.0	91.2	NA	NA	321.6	1
1341.0	51.5	15.0	0.0	120.0	NA	NA	663.2	1
1341.0	51.5	15.0	0.0	122.1	NA	NA	462.2	1
1440.0	53.5	15.0	0.0	111.8	NA	NA	511.7	1
1440.0	53.5	15.0	0.0	148.2	NA	NA	673.7	1
1447.0	57.0	15.0	0.0	65.0	NA	NA	735.7	1
1447.0	57.0	15.0	0.0	107.7	NA	NA	638.3	1
1533.0	54.5	15.0	0.0	61.0	192.9	298.1	491.0	1
1533.0	54.5	15.0	0.0	97.0	192.9	368.3	561.1	1
1533.0	54.5	15.0	0.0	117.2	192.9	368.3	561.1	1
1564.0	51.0	15.0	0.0	63.8	191.1	52.1	243.2	1
1564.0	51.0	15.0	0.0	80.1	191.1	104.2	295.3	1
1564.0	51.0	15.0	0.0	129.0	191.1	243.2	434.2	1
1823.0	57.5	15.0	0.0	44.9	138.1	305.4	443.5	1
1823.0	57.5	15.0	0.0	96.0	138.1	423.5	561.6	1
1823.0	57.5	15.0	0.0	120.2	138.1	335.0	473.1	1
1920.0	57.0	15.0	0.0	50.2	177.4	105.6	283.0	1
1920.0	57.0	15.0	0.0	107.7	177.4	558.3	735.7	1
2098.0	59.0	15.0	0.0	90.3	NA	NA	459.6	1
2143.0	61.0	15.0	0.0	45.1	167.8	29.2	196.9	1
2143.0	61.0	15.0	0.0	95.8	167.8	458.2	626.0	1
2143.0	61.0	15.0	0.0	114.1	167.8	452.6	620.4	1
2168.0	59.5	15.0	0.0	70.2	NA	NA	434.0	1
2168.0	59.5	15.0	0.0	123.2	NA	NA	644.8	1
2173.0	57.5	15.0	0.0	62.1	NA	NA	387.5	1
2173.0	57.5	15.0	0.0	80.5	NA	NA	525.1	1
2173.0	57.5	15.0	0.0	89.1	NA	NA	562.6	1
2173.0	57.5	15.0	0.0	132.8	NA	NA	550.1	1
2216.0	58.0	15.0	0.0	84.1	NA	NA	465.8	1
2216.0	58.0	15.0	0.0	107.9	NA	NA	502.6	1
2216.0	58.0	15.0	0.0	143.3	NA	NA	416.8	1
2288.0	58.0	15.0	0.0	88.2	164.5	258.5	423.0	1
2288.0	58.0	15.0	0.0	139.2	164.5	564.0	728.5	1
2513.0	63.5	15.0	0.0	45.1	NA	NA	335.1	1

Table 6 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
2513.0	63.5	15.0	0.0	92.1	NA	NA	619.8	1

NA: Not Available

‡ Source: 1. Milliken (1983)

Table 7. Swimming costs and total metabolic rates of steelhead trout. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
33.0	15.1	5.0	0.0	18.5	2.5	2.1	4.6	1
33.0	15.1	5.0	0.0	45.1	2.5	4.9	7.4	1
33.0	15.1	5.0	0.0	57.5	2.5	6.7	9.2	1
34.0	15.3	5.0	0.0	18.5	2.0	2.6	4.6	1
34.0	15.3	5.0	0.0	45.1	2.0	4.4	6.4	1
34.0	15.3	5.0	0.0	57.5	2.0	6.2	8.3	1
36.0	15.7	5.0	0.0	18.5	3.1	1.5	4.6	1
36.0	15.7	5.0	0.0	45.1	3.1	5.1	8.3	1
36.0	15.7	5.0	0.0	57.5	3.1	7.0	10.1	1
38.0	16.1	5.0	0.0	18.5	2.3	2.3	4.6	1
38.0	16.1	5.0	0.0	45.1	2.3	5.9	8.3	1
38.0	16.1	5.0	0.0	57.5	2.3	8.7	11.0	1
49.0	17.8	5.0	0.0	18.5	4.2	1.8	6.0	1
49.0	17.8	5.0	0.0	45.1	4.2	6.9	11.0	1
49.0	17.8	5.0	0.0	57.5	4.2	8.7	12.9	1
54.0	18.4	5.0	0.0	18.5	3.3	3.2	6.4	1
54.0	18.4	5.0	0.0	45.1	3.3	7.8	11.0	1
54.0	18.4	5.0	0.0	57.5	3.3	9.6	12.9	1
56.0	18.6	5.0	0.0	18.5	4.2	3.2	7.4	1
56.0	18.6	5.0	0.0	45.1	4.2	7.8	12.0	1
56.0	18.6	5.0	0.0	57.5	4.2	8.7	12.9	1
62.0	19.3	5.0	0.0	18.5	3.3	4.1	7.4	1
62.0	19.3	5.0	0.0	45.1	3.3	9.6	12.9	1
62.0	19.3	5.0	0.0	57.5	3.3	11.4	14.7	1
70.0	20.1	5.0	0.0	18.5	3.7	4.2	7.8	1
70.0	20.1	5.0	0.0	45.1	3.7	10.1	13.8	1
70.0	20.1	5.0	0.0	57.5	3.7	14.7	18.4	1
71.0	20.2	5.0	0.0	18.5	4.5	3.7	8.3	1
71.0	20.2	5.0	0.0	45.1	4.5	6.5	11.0	1
71.0	20.2	5.0	0.0	57.5	4.5	10.2	14.7	1
93.0	22.0	5.0	0.0	18.5	4.7	5.4	10.1	1
93.0	22.0	5.0	0.0	45.1	4.7	11.9	16.6	1
93.0	22.0	5.0	0.0	57.5	4.7	15.6	20.2	1
97.0	22.3	5.0	0.0	18.5	6.7	3.5	10.1	1
97.0	22.3	5.0	0.0	45.1	6.7	9.9	16.6	1
97.0	22.3	5.0	0.0	57.5	6.7	15.4	22.1	1
106.0	22.9	5.0	0.0	18.5	5.9	4.7	10.6	1
106.0	22.9	5.0	0.0	45.1	5.9	10.7	16.6	1
106.0	22.9	5.0	0.0	57.5	5.9	18.1	23.9	1
110.0	23.1	5.0	0.0	18.5	6.3	4.7	11.0	1
110.0	23.1	5.0	0.0	45.1	6.3	14.9	21.2	1
110.0	23.1	5.0	0.0	57.5	6.3	19.5	25.8	1
121.0	23.8	5.0	0.0	18.5	6.1	5.8	12.0	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
121.0	23.8	5.0	0.0	45.1	6.1	14.1	20.2	1
121.0	23.8	5.0	0.0	57.5	6.1	19.6	25.8	1
125.0	24.0	5.0	0.0	18.5	7.7	5.2	12.9	1
125.0	24.0	5.0	0.0	45.1	7.7	14.4	22.1	1
125.0	24.0	5.0	0.0	57.5	7.7	19.0	26.7	1
150.0	25.2	5.0	0.0	18.5	7.7	7.0	14.7	1
150.0	25.2	5.0	0.0	45.1	7.7	16.2	23.9	1
150.0	25.2	5.0	0.0	57.5	7.7	29.1	36.8	1
1200.0	46.5	9.8	0.0	28.1	42.9	62.9	105.8	2
1200.0	46.5	9.8	0.0	31.5	42.9	68.2	111.1	2
1200.0	46.5	9.8	0.0	31.7	42.9	57.1	100.0	2
1200.0	46.5	9.8	0.0	38.3	42.9	86.7	129.6	2
1200.0	46.5	9.8	0.0	38.4	42.9	81.5	124.4	2
1200.0	46.5	9.8	0.0	40.8	42.9	90.9	133.8	2
1200.0	46.5	9.8	0.0	41.2	42.9	108.3	151.2	2
1200.0	46.5	9.8	0.0	41.7	42.9	64.2	107.1	2
1200.0	46.5	9.8	0.0	41.7	42.9	98.2	141.1	2
1200.0	46.5	9.8	0.0	42.3	42.9	83.6	126.5	2
1200.0	46.5	9.8	0.0	46.8	42.9	115.1	158.1	2
1200.0	46.5	9.8	0.0	46.8	42.9	145.2	188.2	2
1200.0	46.5	9.8	0.0	49.1	42.9	87.2	130.1	2
1200.0	46.5	9.8	0.0	49.1	42.9	110.1	153.0	2
1200.0	46.5	9.8	0.0	49.5	42.9	75.6	118.5	2
1200.0	46.5	9.8	0.0	50.0	42.9	159.5	202.4	2
1200.0	46.5	9.8	0.0	50.9	42.9	167.9	210.8	2
1200.0	46.5	9.8	0.0	51.8	42.9	194.2	237.1	2
1200.0	46.5	9.8	0.0	52.0	42.9	115.8	158.7	2
1200.0	46.5	9.8	0.0	52.2	42.9	137.0	179.9	2
1200.0	46.5	9.8	0.0	52.6	42.9	125.7	168.6	2
1200.0	46.5	9.8	0.0	54.1	42.9	110.1	153.0	2
1200.0	46.5	9.8	0.0	55.1	42.9	180.2	223.1	2
1200.0	46.5	9.8	0.0	56.3	42.9	134.9	177.8	2
1200.0	46.5	9.8	0.0	56.5	42.9	166.2	209.1	2
1200.0	46.5	9.8	0.0	57.1	42.9	81.5	124.4	2
1200.0	46.5	9.8	0.0	57.9	42.9	87.7	130.6	2
1200.0	46.5	9.8	0.0	60.4	42.9	108.3	151.2	2
1200.0	46.5	9.8	0.0	61.1	42.9	207.0	249.9	2
1200.0	46.5	9.8	0.0	62.0	42.9	207.0	249.9	2
1200.0	46.5	9.8	0.0	62.8	42.9	230.3	273.2	2
1200.0	46.5	9.8	0.0	63.1	42.9	218.4	261.3	2
1200.0	46.5	9.8	0.0	63.2	42.9	245.1	288.0	2
1200.0	46.5	9.8	0.0	64.6	42.9	193.2	236.1	2
1200.0	46.5	9.8	0.0	65.7	42.9	158.7	201.6	2
1200.0	46.5	9.8	0.0	66.1	42.9	294.4	337.3	2
1200.0	46.5	9.8	0.0	66.2	42.9	214.2	257.1	2
1200.0	46.5	9.8	0.0	67.1	42.9	335.0	377.9	2
1200.0	46.5	9.8	0.0	67.3	42.9	305.5	348.4	2

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
1200.0	46.5	9.8	0.0	68.3	42.9	273.2	316.1	2
1200.0	46.5	9.8	0.0	69.5	42.9	263.1	306.0	2
1200.0	46.5	9.8	0.0	69.7	42.9	308.4	351.3	2
1200.0	46.5	9.8	0.0	70.4	42.9	273.2	316.1	2
1200.0	46.5	9.8	0.0	70.8	42.9	263.1	306.0	2
1200.0	46.5	9.8	0.0	71.1	42.9	285.0	327.9	2
1200.0	46.5	9.8	0.0	71.4	42.9	165.3	208.2	2
1200.0	46.5	9.8	0.0	71.4	42.9	195.1	238.0	2
1200.0	46.5	9.8	0.0	71.9	42.9	319.9	362.8	2
1200.0	46.5	9.8	0.0	72.0	42.9	201.0	243.9	2
1200.0	46.5	9.8	0.0	75.7	42.9	207.0	249.9	2
1200.0	46.5	9.8	0.0	76.4	42.9	317.0	359.9	2
1200.0	46.5	9.8	0.0	76.8	42.9	347.4	390.3	2
1200.0	46.5	9.8	0.0	77.8	42.9	299.9	342.8	2
1200.0	46.5	9.8	0.0	80.1	42.9	382.1	425.0	2
1200.0	46.5	9.8	0.0	80.5	42.9	311.2	354.1	2
1200.0	46.5	9.8	0.0	81.4	42.9	397.9	440.8	2
1200.0	46.5	9.8	0.0	81.5	42.9	416.1	459.0	2
1200.0	46.5	9.8	0.0	81.9	42.9	383.8	426.7	2
1200.0	46.5	9.8	0.0	83.2	42.9	387.3	430.2	2
1200.0	46.5	9.8	0.0	83.2	42.9	408.7	451.6	2
1200.0	46.5	9.8	0.0	33.2	42.9	419.9	462.8	2
1200.0	46.5	9.8	0.0	83.2	42.9	433.2	476.1	2
1200.0	46.5	9.8	0.0	83.2	42.9	450.9	493.8	2
1200.0	46.5	9.8	0.0	83.2	42.9	427.4	470.3	2
1200.0	46.5	9.8	0.0	84.6	42.9	375.3	418.2	2
1200.0	46.5	9.8	0.0	84.6	42.9	427.4	470.3	2
1200.0	46.5	9.8	0.0	84.7	42.9	394.3	437.2	2
6.5	4.3	10.0	0.0	5.2	0.7	0.3	1.0	3
6.5	4.3	10.0	0.0	5.2	0.7	0.2	0.9	3
6.5	4.3	10.0	0.0	5.2	0.7	0.3	1.0	3
6.5	4.3	10.0	0.0	9.7	0.7	0.4	1.1	3
6.5	4.3	10.0	0.0	10.0	0.7	0.3	1.0	3
6.5	4.3	10.0	0.0	10.6	0.7	0.7	1.4	3
6.5	4.3	10.0	0.0	10.6	0.7	0.7	1.4	3
6.5	4.3	10.0	0.0	10.6	0.7	0.8	1.5	3
6.5	4.3	10.0	0.0	10.9	0.7	0.2	0.9	3
6.5	4.3	10.0	0.0	11.2	0.7	0.6	1.3	3
6.5	4.3	10.0	0.0	11.9	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	11.9	0.7	1.2	1.9	3
6.5	4.3	10.0	0.0	11.9	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	12.9	0.7	1.4	2.1	3
6.5	4.3	10.0	0.0	14.6	0.7	0.5	1.2	3
6.5	4.3	10.0	0.0	15.3	0.7	0.8	1.5	3
6.5	4.3	10.0	0.0	15.3	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	15.3	0.7	0.6	1.3	3
6.5	4.3	10.0	0.0	15.5	0.7	1.0	1.7	3

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
6.5	4.3	10.0	0.0	15.5	0.7	0.9	1.6	3
6.5	4.3	10.0	0.0	15.7	0.7	0.7	1.4	3
6.5	4.3	10.0	0.0	16.1	0.7	0.8	1.5	3
6.5	4.3	10.0	0.0	16.3	0.7	0.5	1.2	3
6.5	4.3	10.0	0.0	17.4	0.7	0.7	1.4	3
6.5	4.3	10.0	0.0	17.7	0.7	1.4	2.1	3
6.5	4.3	10.0	0.0	17.9	0.7	1.1	1.8	3
6.5	4.3	10.0	0.0	18.2	0.7	1.1	1.8	3
6.5	4.3	10.0	0.0	18.4	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	19.5	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	21.0	0.7	0.8	1.5	3
6.5	4.3	10.0	0.0	22.1	0.7	1.2	1.9	3
6.5	4.3	10.0	0.0	22.1	0.7	1.1	1.8	3
6.5	4.3	10.0	0.0	22.4	0.7	1.6	2.3	3
6.5	4.3	10.0	0.0	22.7	0.7	1.0	1.7	3
6.5	4.3	10.0	0.0	24.0	0.7	1.6	2.3	3
6.5	4.3	10.0	0.0	24.3	0.7	1.6	2.3	3
6.5	4.3	10.0	0.0	25.4	0.7	2.0	2.7	3
6.5	4.3	10.0	0.0	25.5	0.7	1.8	2.5	3
6.5	4.3	10.0	0.0	25.5	0.7	2.6	3.3	3
3.9	7.0	11.0	0.0	7.0	NA	NA	0.8	4
5.3	7.8	14.0	0.0	7.8	NA	NA	1.4	4
54.0	18.4	15.0	0.0	18.5	8.1	4.8	12.9	1
54.0	18.4	15.0	0.0	45.1	8.1	10.3	18.4	1
54.0	18.4	15.0	0.0	72.7	8.1	19.5	27.6	1
59.0	19.0	15.0	0.0	18.5	6.3	6.6	12.9	1
59.0	19.0	15.0	0.0	45.1	6.3	12.1	18.4	1
59.0	19.0	15.0	0.0	72.7	6.3	25.9	32.2	1
61.0	19.2	15.0	0.0	18.5	7.4	1.8	9.2	1
61.0	19.2	15.0	0.0	45.1	7.4	12.0	19.3	1
61.0	19.2	15.0	0.0	72.7	7.4	15.6	23.0	1
63.0	19.4	15.0	0.0	18.5	9.5	0.6	10.1	1
63.0	19.4	15.0	0.0	45.1	9.5	7.0	16.6	1
63.0	19.4	15.0	0.0	72.7	9.5	18.1	27.6	1
85.0	21.4	15.0	0.0	18.5	9.5	7.0	16.6	1
85.0	21.4	15.0	0.0	45.1	9.5	13.5	23.0	1
85.0	21.4	15.0	0.0	72.7	9.5	32.3	41.9	1
87.0	21.6	15.0	0.0	18.5	9.5	4.3	13.8	1
87.0	21.6	15.0	0.0	45.1	9.5	12.6	22.1	1
87.0	21.6	15.0	0.0	72.7	9.5	22.7	32.2	1
89.0	21.7	15.0	0.0	18.5	10.2	4.5	14.7	1
89.0	21.7	15.0	0.0	45.1	10.2	13.7	23.9	1
89.0	21.7	15.0	0.0	72.7	10.2	28.4	38.6	1
94.5	22.1	15.0	0.0	18.5	10.2	6.3	16.6	1
94.5	22.1	15.0	0.0	45.1	10.2	15.5	25.8	1
94.5	22.1	15.0	0.0	72.7	10.2	31.6	41.9	1
95.0	22.2	15.0	0.0	18.5	9.5	7.0	16.6	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
95.0	22.2	15.0	0.0	45.1	9.5	19.9	29.4	1
95.0	22.2	15.0	0.0	72.7	9.5	32.3	41.9	1
98.0	22.4	15.0	0.0	18.5	11.0	3.7	14.7	1
98.0	22.4	15.0	0.0	18.5	11.0	7.4	18.4	1
98.0	22.4	15.0	0.0	45.1	11.0	11.1	22.1	1
98.0	22.4	15.0	0.0	45.1	11.0	14.8	25.8	1
98.0	22.4	15.0	0.0	72.7	11.0	30.9	41.9	1
98.0	22.4	15.0	0.0	72.7	11.0	27.7	38.6	1
120.0	23.7	15.0	0.0	18.5	13.9	5.4	19.3	1
120.0	23.7	15.0	0.0	45.1	13.9	15.5	29.4	1
120.0	23.7	15.0	0.0	72.7	13.9	41.3	55.2	1
122.0	23.8	15.0	0.0	18.5	13.2	8.9	22.1	1
122.0	23.8	15.0	0.0	45.1	13.2	31.0	44.2	1
122.0	23.8	15.0	0.0	72.7	13.2	48.5	61.6	1
131.0	24.3	15.0	0.0	18.5	14.6	5.6	20.2	1
131.0	24.3	15.0	0.0	45.1	14.6	27.7	42.3	1
131.0	24.3	15.0	0.0	72.7	14.6	47.0	61.6	1
133.0	24.4	15.0	0.0	18.5	14.6	8.4	23.0	1
133.0	24.4	15.0	0.0	45.1	14.6	19.4	34.0	1
133.0	24.4	15.0	0.0	72.7	14.6	40.6	55.2	1
135.0	24.5	15.0	0.0	18.5	14.6	5.6	20.2	1
135.0	24.5	15.0	0.0	45.1	14.6	22.2	36.8	1
135.0	24.5	15.0	0.0	72.7	14.6	40.6	55.2	1
263.7	29.2	15.0	0.0	10.2	22.9	15.9	38.8	5
263.7	29.2	15.0	0.0	16.9	22.9	16.7	39.6	5
263.7	29.2	15.0	0.0	24.2	22.9	29.6	52.6	5
263.7	29.2	15.0	0.0	30.6	22.9	39.8	62.7	5
263.7	29.2	15.0	0.0	37.4	22.9	54.7	77.6	5
263.7	29.2	15.0	0.0	44.2	22.9	70.7	93.6	5
263.7	29.2	15.0	0.0	51.0	22.9	105.7	128.7	5
263.7	29.2	15.0	0.0	57.9	22.9	150.4	173.4	5
263.7	29.2	15.0	0.0	64.2	22.9	228.7	251.6	5
286.0	30.8	15.0	0.0	18.5	27.8	49.0	21.2	6
286.0	30.8	15.0	0.0	24.6	27.8	62.8	35.1	6
286.0	30.8	15.0	0.0	30.8	27.8	71.2	43.4	6
286.0	30.8	15.0	0.0	37.0	27.8	87.5	59.8	6
286.0	30.8	15.0	0.0	43.1	27.8	99.1	71.4	6
286.0	30.8	15.0	0.0	49.3	27.8	121.9	94.2	6
286.0	30.8	15.0	0.0	54.2	27.8	136.1	108.4	6
300.0	30.0	15.0	0.0	5.5	24.5	4.7	29.3	7
300.0	30.0	15.0	0.0	21.9	24.5	14.4	38.9	7
300.0	30.0	15.0	0.0	38.3	24.5	41.5	66.0	7
300.0	30.0	15.0	0.0	54.8	24.5	71.0	95.6	7
6.5	4.3	20.0	0.0	7.7	1.4	0.7	2.1	3
6.5	4.3	20.0	0.0	8.4	1.4	0.4	1.8	3
6.5	4.3	20.0	0.0	8.7	1.4	0.4	1.8	3
6.5	4.3	20.0	0.0	9.4	1.4	0.4	1.8	3

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
6.5	4.3	20.0	0.0	10.1	1.4	0.9	2.3	3
6.5	4.3	20.0	0.0	10.5	1.4	0.7	2.1	3
6.5	4.3	20.0	0.0	10.5	1.4	1.2	2.6	3
6.5	4.3	20.0	0.0	10.6	1.4	0.9	2.3	3
6.5	4.3	20.0	0.0	10.8	1.4	2.3	3.7	3
6.5	4.3	20.0	0.0	11.1	1.4	0.8	2.2	3
6.5	4.3	20.0	0.0	11.2	1.4	0.7	2.1	3
6.5	4.3	20.0	0.0	11.2	1.4	0.8	2.2	3
6.5	4.3	20.0	0.0	11.5	1.4	0.6	2.0	3
6.5	4.3	20.0	0.0	11.9	1.4	1.3	2.7	3
6.5	4.3	20.0	0.0	12.4	1.4	1.5	2.9	3
6.5	4.3	20.0	0.0	12.7	1.4	1.9	3.3	3
6.5	4.3	20.0	0.0	12.9	1.4	1.1	2.5	3
6.5	4.3	20.0	0.0	13.2	1.4	0.8	2.2	3
6.5	4.3	20.0	0.0	13.5	1.4	0.5	1.9	3
6.5	4.3	20.0	0.0	14.6	1.4	0.4	1.8	3
6.5	4.3	20.0	0.0	15.0	1.4	1.8	3.2	3
6.5	4.3	20.0	0.0	15.2	1.4	1.5	2.9	3
6.5	4.3	20.0	0.0	15.3	1.4	0.8	2.2	3
6.5	4.3	20.0	0.0	15.4	1.4	0.2	1.6	3
6.5	4.3	20.0	0.0	15.7	1.4	0.2	1.6	3
6.5	4.3	20.0	0.0	16.1	1.4	0.8	2.2	3
6.5	4.3	20.0	0.0	16.1	1.4	1.0	2.4	3
6.5	4.3	20.0	0.0	16.2	1.4	1.1	2.5	3
6.5	4.3	20.0	0.0	17.4	1.4	1.3	2.7	3
6.5	4.3	20.0	0.0	17.5	1.4	2.4	3.8	3
6.5	4.3	20.0	0.0	17.7	1.4	1.6	3.0	3
6.5	4.3	20.0	0.0	17.8	1.4	3.0	4.4	3
6.5	4.3	20.0	0.0	18.6	1.4	3.6	5.0	3
6.5	4.3	20.0	0.0	19.0	1.4	3.5	4.9	3
6.5	4.3	20.0	0.0	19.4	1.4	1.6	3.0	3
6.5	4.3	20.0	0.0	19.9	1.4	2.2	3.6	3
6.5	4.3	20.0	0.0	20.4	1.4	3.0	4.4	3
6.5	4.3	20.0	0.0	20.4	1.4	3.5	4.9	3
6.5	4.3	20.0	0.0	20.8	1.4	3.6	5.0	3
6.5	4.3	20.0	0.0	20.9	1.4	5.7	7.1	3
6.5	4.3	20.0	0.0	20.9	1.4	1.8	3.2	3
6.5	4.3	20.0	0.0	21.1	1.4	2.2	3.5	3
6.5	4.3	20.0	0.0	21.2	1.4	0.6	1.9	3
6.5	4.3	20.0	0.0	21.2	1.4	2.0	3.4	3
6.5	4.3	20.0	0.0	21.2	1.4	1.9	3.3	3
6.5	4.3	20.0	0.0	21.8	1.4	0.7	2.1	3
6.5	4.3	20.0	0.0	22.0	1.4	1.8	3.2	3
6.5	4.3	20.0	0.0	22.0	1.4	3.4	4.7	3
6.5	4.3	20.0	0.0	22.7	1.4	2.4	3.8	3
6.5	4.3	20.0	0.0	22.7	1.4	3.8	5.2	3
6.5	4.3	20.0	0.0	23.2	1.4	2.1	3.5	3

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
6.5	4.3	20.0	0.0	23.3	1.4	4.7	6.1	3
6.5	4.3	20.0	0.0	23.3	1.4	3.5	4.9	3
6.5	4.3	20.0	0.0	23.3	1.4	1.5	2.9	3
6.5	4.3	20.0	0.0	23.5	1.4	2.7	4.1	3
6.5	4.3	20.0	0.0	23.9	1.4	1.6	3.0	3
6.5	4.3	20.0	0.0	23.9	1.4	3.2	4.6	3
6.5	4.3	20.0	0.0	29.4	1.4	1.6	3.0	3
57.0	18.8	15.0	3.8	18.5	7.3	2.8	10.1	1
57.0	18.8	15.0	3.8	45.1	7.3	7.4	14.7	1
57.0	18.8	15.0	3.8	72.7	7.3	14.8	22.1	1
72.0	20.3	15.0	3.8	18.5	7.3	4.6	12.0	1
72.0	20.3	15.0	3.8	45.1	7.3	11.1	18.4	1
72.0	20.3	15.0	3.8	72.7	7.3	22.1	29.4	1
76.0	20.7	15.0	3.8	18.5	8.1	3.9	12.0	1
76.0	20.7	15.0	3.8	45.1	8.1	10.3	18.4	1
76.0	20.7	15.0	3.8	72.7	8.1	25.1	33.1	1
81.0	21.1	15.0	3.8	18.5	8.4	5.8	14.3	1
81.0	21.1	15.0	3.8	45.1	8.4	11.8	20.2	1
81.0	21.1	15.0	3.8	72.7	8.4	24.7	33.1	1
84.0	21.3	15.0	3.8	18.5	7.3	4.6	12.0	1
84.0	21.3	15.0	3.8	45.1	7.3	13.8	21.2	1
84.0	21.3	15.0	3.8	72.7	7.3	25.8	33.1	1
106.0	22.9	15.0	3.8	18.5	9.0	7.1	16.1	1
106.0	22.9	15.0	3.8	45.1	9.0	17.7	26.7	1
106.0	22.9	15.0	3.8	72.7	9.0	29.7	38.6	1
110.0	23.1	15.0	3.8	18.5	13.2	5.2	18.4	1
110.0	23.1	15.0	3.8	18.5	8.8	9.6	18.4	1
110.0	23.1	15.0	3.8	45.1	13.2	16.3	29.4	1
110.0	23.1	15.0	3.8	45.1	8.8	21.6	30.4	1
110.0	23.1	15.0	3.8	72.7	13.2	25.5	38.6	1
110.0	23.1	15.0	3.8	72.7	8.8	31.7	40.5	1
122.0	23.8	15.0	3.8	18.5	13.2	2.9	16.1	1
122.0	23.8	15.0	3.8	45.1	13.2	16.3	29.4	1
122.0	23.8	15.0	3.8	72.7	13.2	31.0	44.2	1
124.0	23.9	15.0	3.8	18.5	10.6	8.2	18.9	1
124.0	23.9	15.0	3.8	45.1	10.6	22.5	33.1	1
124.0	23.9	15.0	3.8	72.7	10.6	37.2	47.8	1
126.0	24.0	15.0	3.8	18.5	11.2	7.7	18.9	1
126.0	24.0	15.0	3.8	45.1	11.2	21.0	32.2	1
126.0	24.0	15.0	3.8	72.7	11.2	38.5	49.7	1
134.0	24.5	15.0	3.8	18.5	12.4	6.4	18.9	1
134.0	24.5	15.0	3.8	45.1	12.4	22.5	35.0	1
134.0	24.5	15.0	3.8	72.7	12.4	41.8	54.3	1
136.0	24.6	15.0	3.8	18.5	13.2	6.1	19.3	1
136.0	24.6	15.0	3.8	45.1	13.2	21.8	35.0	1
136.0	24.6	15.0	3.8	72.7	13.2	41.1	54.3	1
156.0	25.5	15.0	3.8	18.5	16.1	4.1	20.2	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
156.0	25.5	15.0	3.8	45.1	16.1	22.5	38.6	1
156.0	25.5	15.0	3.8	72.7	16.1	38.2	54.3	1
4.4	7.2	14.0	4.0	7.2	NA	NA	1.3	4
27.0	13.8	5.0	7.5	18.5	2.2	1.5	3.7	1
27.0	13.8	5.0	7.5	45.1	2.2	2.4	4.6	1
27.0	13.8	5.0	7.5	57.5	2.2	4.2	6.4	1
27.5	13.9	5.0	7.5	18.5	1.9	1.8	3.7	1
27.5	13.9	5.0	7.5	45.1	1.9	3.6	5.5	1
27.5	13.9	5.0	7.5	57.5	1.9	4.5	6.4	1
32.0	14.9	5.0	7.5	18.5	2.2	1.5	3.7	1
32.0	14.9	5.0	7.5	45.1	2.2	3.3	5.5	1
32.0	14.9	5.0	7.5	57.5	2.2	4.2	6.4	1
33.0	15.1	5.0	7.5	18.5	2.9	0.8	3.7	1
33.0	15.1	5.0	7.5	45.1	2.9	2.6	5.5	1
33.0	15.1	5.0	7.5	57.5	2.9	3.5	6.4	1
55.0	18.5	5.0	7.5	18.5	3.3	2.2	5.5	1
55.0	18.5	5.0	7.5	45.1	3.3	5.4	8.7	1
55.0	18.5	5.0	7.5	57.5	3.3	6.8	10.1	1
60.0	19.1	5.0	7.5	18.5	3.7	2.3	6.0	1
60.0	19.1	5.0	7.5	45.1	3.7	5.5	9.2	1
60.0	19.1	5.0	7.5	57.5	3.7	7.4	11.0	1
81.0	21.1	5.0	7.5	18.5	4.8	3.1	7.8	1
81.0	21.1	5.0	7.5	45.1	4.8	8.0	12.8	1
81.0	21.1	5.0	7.5	57.5	4.8	10.0	14.7	1
97.0	22.3	5.0	7.5	18.5	4.8	5.4	10.1	1
97.0	22.3	5.0	7.5	45.1	4.8	6.7	11.5	1
97.0	22.3	5.0	7.5	57.5	4.8	10.9	15.6	1
103.0	22.7	5.0	7.5	18.5	5.6	3.2	8.7	1
103.0	22.7	5.0	7.5	45.1	5.6	9.2	14.7	1
103.0	22.7	5.0	7.5	57.5	5.6	11.9	17.5	1
105.0	22.8	5.0	7.5	18.5	6.1	2.6	8.7	1
105.0	22.8	5.0	7.5	45.1	6.1	6.7	12.9	1
105.0	22.8	5.0	7.5	57.5	6.1	11.3	17.5	1
110.0	23.1	5.0	7.5	18.5	6.1	4.0	10.1	1
110.0	23.1	5.0	7.5	45.1	6.1	10.9	17.0	1
110.0	23.1	5.0	7.5	57.5	6.1	17.8	23.9	1
115.0	23.4	5.0	7.5	18.5	5.7	4.4	10.1	1
115.0	23.4	5.0	7.5	45.1	5.7	7.2	12.9	1
115.0	23.4	5.0	7.5	57.5	5.7	11.7	17.4	1
130.0	24.3	5.0	7.5	18.5	7.0	3.6	10.6	1
130.0	24.3	5.0	7.5	45.1	7.0	10.1	17.0	1
130.0	24.3	5.0	7.5	57.5	7.0	17.0	23.9	1
140.0	24.7	5.0	7.5	18.5	8.1	2.5	10.6	1
140.0	24.7	5.0	7.5	45.1	8.1	9.4	17.5	1
140.0	24.7	5.0	7.5	57.5	8.1	15.9	23.9	1
142.0	24.8	5.0	7.5	18.5	7.0	5.0	12.0	1
142.0	24.8	5.0	7.5	45.1	7.0	10.5	17.5	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
142.0	24.8	5.0	7.5	57.5	7.0	14.2	21.2	1
145.0	25.0	5.0	7.5	18.5	7.0	5.0	12.0	1
145.0	25.0	5.0	7.5	45.1	7.0	10.5	17.5	1
145.0	25.0	5.0	7.5	57.5	7.0	17.0	23.9	1
153.0	25.3	5.0	7.5	18.5	7.0	4.1	11.0	1
153.0	25.3	5.0	7.5	45.1	7.0	11.9	18.9	1
153.0	25.3	5.0	7.5	57.5	7.0	22.5	29.4	1
47.0	17.5	15.0	7.5	18.5	5.9	1.5	7.4	1
47.0	17.5	15.0	7.5	45.1	5.9	5.2	11.0	1
47.0	17.5	15.0	7.5	72.7	5.9	12.5	18.4	1
53.0	18.3	15.0	7.5	18.5	4.4	3.9	8.3	1
53.0	18.3	15.0	7.5	45.1	4.4	8.5	12.9	1
53.0	18.3	15.0	7.5	72.7	4.4	19.1	23.5	1
72.0	20.3	15.0	7.5	18.5	8.1	1.1	9.2	1
72.0	20.3	15.0	7.5	45.1	8.1	8.5	16.6	1
72.0	20.3	15.0	7.5	72.7	8.1	17.7	25.8	1
77.0	20.8	15.0	7.5	18.5	7.3	3.7	11.0	1
77.0	20.8	15.0	7.5	45.1	7.3	11.1	18.4	1
77.0	20.8	15.0	7.5	72.7	7.3	18.4	25.8	1
78.0	20.8	15.0	7.5	18.5	8.4	4.5	12.9	1
78.0	20.8	15.0	7.5	45.1	8.4	8.1	16.6	1
78.0	20.8	15.0	7.5	72.7	8.4	19.2	27.6	1
84.0	21.3	15.0	7.5	18.5	8.1	3.0	11.0	1
84.0	21.3	15.0	7.5	45.1	8.1	8.5	16.6	1
84.0	21.3	15.0	7.5	72.7	8.1	19.5	27.6	1
88.0	21.7	15.0	7.5	18.5	7.7	6.1	13.8	1
88.0	21.7	15.0	7.5	18.5	9.5	3.4	12.9	1
88.0	21.7	15.0	7.5	45.1	7.7	13.5	21.2	1
88.0	21.7	15.0	7.5	45.1	9.5	11.6	21.2	1
88.0	21.7	15.0	7.5	72.7	7.7	25.4	33.1	1
88.0	21.7	15.0	7.5	72.7	9.5	29.9	39.4	1
93.0	22.0	15.0	7.5	18.5	8.1	3.0	11.0	1
93.0	22.0	15.0	7.5	45.1	8.1	13.1	21.2	1
93.0	22.0	15.0	7.5	72.7	8.1	25.1	33.1	1
99.0	22.4	15.0	7.5	18.5	8.1	5.7	13.8	1
99.0	22.4	15.0	7.5	18.5	9.5	4.3	13.8	1
99.0	22.4	15.0	7.5	45.1	8.1	13.1	21.2	1
99.0	22.4	15.0	7.5	45.1	9.5	13.9	23.5	1
99.0	22.4	15.0	7.5	72.7	8.1	19.5	27.6	1
99.0	22.4	15.0	7.5	72.7	9.5	31.0	40.5	1
107.0	23.0	15.0	7.5	18.5	8.4	5.4	13.8	1
107.0	23.0	15.0	7.5	45.1	8.4	16.4	24.8	1
107.0	23.0	15.0	7.5	72.7	8.4	25.6	34.0	1
110.0	23.1	15.0	7.5	18.5	10.6	3.2	13.8	1
110.0	23.1	15.0	7.5	45.1	10.6	15.1	25.8	1
110.0	23.1	15.0	7.5	72.7	10.6	28.5	39.1	1
120.0	23.7	15.0	7.5	18.5	13.2	1.5	14.7	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
120.0	23.7	15.0	7.5	45.1	13.2	12.6	25.8	1
120.0	23.7	15.0	7.5	72.7	13.2	27.3	40.5	1
138.0	24.6	15.0	7.5	18.5	12.4	3.7	16.1	1
138.0	24.6	15.0	7.5	45.1	12.4	19.8	32.2	1
138.0	24.6	15.0	7.5	72.7	12.4	37.2	49.7	1
4.8	7.4	14.0	8.0	7.4	NA	NA	1.5	4
3.7	6.8	11.0	9.0	6.8	NA	NA	0.9	4
4.6	7.3	14.0	12.0	7.3	NA	NA	1.4	4
28.0	14.0	5.0	15.0	18.5	2.6	1.1	3.7	1
28.0	14.0	5.0	15.0	45.1	2.6	3.8	6.4	1
28.0	14.0	5.0	15.0	57.5	2.6	5.7	8.3	1
35.0	15.5	5.0	15.0	18.5	2.6	3.0	5.5	1
35.0	15.5	5.0	15.0	45.1	2.6	4.8	7.4	1
35.0	15.5	5.0	15.0	57.5	2.6	7.6	10.1	1
50.0	17.9	5.0	15.0	18.5	3.1	3.8	6.9	1
50.0	17.9	5.0	15.0	45.1	3.1	8.0	11.0	1
50.0	17.9	5.0	15.0	57.5	3.1	10.7	13.8	1
55.0	18.5	5.0	15.0	18.5	3.7	3.2	6.9	1
55.0	18.5	5.0	15.0	45.1	3.7	7.4	11.0	1
55.0	18.5	5.0	15.0	57.5	3.7	12.0	15.6	1
62.0	19.3	5.0	15.0	18.5	3.7	3.2	6.9	1
62.0	19.3	5.0	15.0	45.1	3.7	6.5	10.1	1
62.0	19.3	5.0	15.0	57.5	3.7	8.8	12.4	1
65.0	19.6	5.0	15.0	18.5	4.0	3.8	7.8	1
65.0	19.6	5.0	15.0	45.1	4.0	10.2	14.3	1
65.0	19.6	5.0	15.0	57.5	4.0	14.4	18.4	1
70.0	20.1	5.0	15.0	18.5	3.7	4.2	7.8	1
70.0	20.1	5.0	15.0	45.1	3.7	11.1	14.7	1
70.0	20.1	5.0	15.0	57.5	3.7	14.7	18.4	1
72.0	20.3	5.0	15.0	18.5	4.0	3.3	7.4	1
72.0	20.3	5.0	15.0	45.1	4.0	8.9	12.9	1
72.0	20.3	5.0	15.0	57.5	4.0	11.2	15.2	1
73.0	20.4	5.0	15.0	18.5	4.2	3.6	7.8	1
73.0	20.4	5.0	15.0	45.1	4.2	12.3	16.6	1
73.0	20.4	5.0	15.0	57.5	4.2	16.9	21.2	1
87.0	21.6	5.0	15.0	18.5	5.9	4.2	10.1	1
87.0	21.6	5.0	15.0	45.1	5.9	9.3	15.2	1
87.0	21.6	5.0	15.0	57.5	5.9	12.5	18.4	1
96.0	22.2	5.0	15.0	18.5	5.4	5.6	11.0	1
96.0	22.2	5.0	15.0	45.1	5.4	12.1	17.5	1
96.0	22.2	5.0	15.0	57.5	5.4	18.5	23.9	1
103.0	22.7	5.0	15.0	18.5	5.9	5.2	11.0	1
103.0	22.7	5.0	15.0	45.1	5.9	12.5	18.4	1
103.0	22.7	5.0	15.0	57.5	5.9	18.1	23.9	1
107.0	23.0	5.0	15.0	18.5	5.7	5.8	11.5	1
107.0	23.0	5.0	15.0	45.1	5.7	13.6	19.3	1
107.0	23.0	5.0	15.0	57.5	5.7	21.9	27.6	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
124.0	23.9	5.0	15.0	18.5	8.1	5.3	13.3	1
124.0	23.9	5.0	15.0	45.1	8.1	14.0	22.1	1
124.0	23.9	5.0	15.0	57.5	8.1	22.3	30.4	1
140.0	24.7	5.0	15.0	18.5	9.5	3.8	13.3	1
140.0	24.7	5.0	15.0	45.1	9.5	12.6	22.1	1
140.0	24.7	5.0	15.0	57.5	9.5	21.8	31.3	1
146.0	25.0	5.0	15.0	18.5	9.5	3.8	13.3	1
146.0	25.0	5.0	15.0	45.1	9.5	17.2	26.7	1
146.0	25.0	5.0	15.0	57.5	9.5	30.0	39.6	1
149.0	25.2	5.0	15.0	18.5	9.2	5.6	14.7	1
149.0	25.2	5.0	15.0	45.1	9.2	13.9	23.0	1
149.0	25.2	5.0	15.0	57.5	9.2	30.4	39.6	1
24.0	13.0	15.0	15.0	18.5	3.3	2.7	6.0	1
24.0	13.0	15.0	15.0	18.5	3.7	1.9	5.5	1
24.0	13.0	15.0	15.0	45.1	3.3	5.0	8.3	1
24.0	13.0	15.0	15.0	45.1	3.7	5.5	9.2	1
24.0	13.0	15.0	15.0	72.7	3.3	7.7	11.0	1
24.0	13.0	15.0	15.0	72.7	3.7	8.8	12.4	1
27.0	13.8	15.0	15.0	18.5	4.6	1.4	6.0	1
27.0	13.8	15.0	15.0	45.1	4.6	4.1	8.7	1
27.0	13.8	15.0	15.0	72.7	4.6	7.8	12.4	1
36.0	15.7	15.0	15.0	18.5	4.9	3.4	8.3	1
36.0	15.7	15.0	15.0	45.1	4.9	8.0	12.9	1
36.0	15.7	15.0	15.0	72.7	4.9	11.2	16.1	1
39.0	16.2	15.0	15.0	18.5	4.9	2.5	7.4	1
39.0	16.2	15.0	15.0	45.1	4.9	8.0	12.9	1
39.0	16.2	15.0	15.0	72.7	4.9	16.3	21.2	1
55.0	18.5	15.0	15.0	18.5	6.7	6.2	12.9	1
55.0	18.5	15.0	15.0	45.1	6.7	7.1	13.8	1
55.0	18.5	15.0	15.0	72.7	6.7	18.1	24.8	1
56.0	18.6	15.0	15.0	18.5	7.3	2.8	10.1	1
56.0	18.6	15.0	15.0	45.1	7.3	10.2	17.5	1
56.0	18.6	15.0	15.0	72.7	7.3	17.5	24.8	1
69.0	20.0	15.0	15.0	18.5	7.7	3.8	11.5	1
69.0	20.0	15.0	15.0	45.1	7.7	7.0	14.7	1
69.0	20.0	15.0	15.0	72.7	7.7	32.8	40.5	1
74.0	20.5	15.0	15.0	18.5	7.5	6.8	14.3	1
74.0	20.5	15.0	15.0	45.1	7.5	16.4	23.9	1
74.0	20.5	15.0	15.0	72.7	7.5	33.0	40.5	1
97.0	22.3	15.0	15.0	18.5	11.7	3.5	15.2	1
97.0	22.3	15.0	15.0	45.1	11.7	9.4	21.2	1
97.0	22.3	15.0	15.0	72.7	11.7	28.8	40.5	1
98.0	22.4	15.0	15.0	18.5	11.7	7.6	19.3	1
98.0	22.4	15.0	15.0	45.1	11.7	12.2	23.9	1
98.0	22.4	15.0	15.0	72.7	11.7	27.4	39.1	1
110.0	23.1	15.0	15.0	18.5	14.6	4.7	19.3	1
110.0	23.1	15.0	15.0	45.1	14.6	18.5	33.1	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
110.0	23.1	15.0	15.0	72.7	14.6	36.0	50.6	1
118.0	23.6	15.0	15.0	18.5	11.7	7.6	19.3	1
118.0	23.6	15.0	15.0	45.1	11.7	21.4	33.1	1
118.0	23.6	15.0	15.0	72.7	11.7	38.9	50.6	1
126.0	24.0	15.0	15.0	18.5	11.0	10.2	21.2	1
126.0	24.0	15.0	15.0	45.1	11.0	28.6	39.6	1
126.0	24.0	15.0	15.0	72.7	11.0	39.6	50.6	1
4.0	7.0	14.0	16.0	7.0	NA	NA	1.4	4
1.8	5.5	11.0	18.0	5.5	NA	NA	0.5	4
45.0	17.2	15.0	22.5	18.5	5.9	4.3	10.1	1
45.0	17.2	15.0	22.5	45.1	5.9	9.8	15.6	1
45.0	17.2	15.0	22.5	72.7	5.9	23.4	29.2	1
66.0	19.7	15.0	22.5	18.5	7.3	7.4	14.7	1
66.0	19.7	15.0	22.5	45.1	7.3	13.8	21.2	1
66.0	19.7	15.0	22.5	72.7	7.3	25.8	33.1	1
70.0	20.1	15.0	22.5	18.5	11.0	1.9	12.9	1
70.0	20.1	15.0	22.5	45.1	11.0	12.0	23.0	1
70.0	20.1	15.0	22.5	72.7	11.0	22.1	33.1	1
74.0	20.5	15.0	22.5	18.5	8.8	5.9	14.7	1
74.0	20.5	15.0	22.5	45.1	8.8	15.1	23.9	1
74.0	20.5	15.0	22.5	72.7	8.8	24.3	33.1	1
76.0	20.7	15.0	22.5	18.5	11.0	3.7	14.7	1
76.0	20.7	15.0	22.5	45.1	11.0	12.9	23.9	1
76.0	20.7	15.0	22.5	72.7	11.0	24.0	35.0	1
89.0	21.7	15.0	22.5	18.5	9.5	8.0	17.5	1
89.0	21.7	15.0	22.5	45.1	9.5	16.2	25.8	1
89.0	21.7	15.0	22.5	72.7	9.5	30.0	39.6	1
99.0	22.4	15.0	22.5	18.5	14.6	3.8	18.4	1
99.0	22.4	15.0	22.5	45.1	14.6	16.6	31.3	1
99.0	22.4	15.0	22.5	72.7	14.6	33.2	47.8	1
110.0	23.1	15.0	22.5	18.5	9.5	8.9	18.4	1
110.0	23.1	15.0	22.5	45.1	9.5	16.2	25.8	1
110.0	23.1	15.0	22.5	72.7	9.5	30.0	39.6	1
115.0	23.4	15.0	22.5	18.5	11.0	10.2	21.2	1
115.0	23.4	15.0	22.5	45.1	11.0	20.3	31.3	1
115.0	23.4	15.0	22.5	72.7	11.0	38.7	49.7	1
122.0	23.8	15.0	22.5	18.5	14.6	6.5	21.2	1
122.0	23.8	15.0	22.5	45.1	14.6	20.3	35.0	1
122.0	23.8	15.0	22.5	72.7	14.6	48.8	63.5	1
125.0	24.0	15.0	22.5	18.5	13.2	11.6	24.8	1
125.0	24.0	15.0	22.5	45.1	13.2	26.4	39.6	1
125.0	24.0	15.0	22.5	72.7	13.2	38.3	51.5	1
139.0	24.7	15.0	22.5	18.5	14.6	7.4	22.1	1
139.0	24.7	15.0	22.5	45.1	14.6	22.2	36.8	1
139.0	24.7	15.0	22.5	72.7	14.6	48.8	63.5	1
145.0	25.0	15.0	22.5	18.5	16.5	8.4	24.8	1
145.0	25.0	15.0	22.5	45.1	16.5	22.2	38.6	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	P_a (mg O_2/h)	R_T (mg O_2/h)	Source
145.0	25.0	15.0	22.5	72.7	16.5	40.6	57.0	1
160.0	25.6	15.0	22.5	18.5	14.6	10.2	24.8	1
160.0	25.6	15.0	22.5	45.1	14.6	24.0	38.6	1
160.0	25.6	15.0	22.5	72.7	14.6	48.8	63.5	1
25.0	13.3	5.0	30.0	18.5	3.3	1.8	5.1	1
25.0	13.3	5.0	30.0	45.1	3.3	3.2	6.4	1
25.0	13.3	5.0	30.0	57.5	3.3	4.1	7.4	1
33.0	15.1	5.0	30.0	18.5	3.7	1.9	5.5	1
33.0	15.1	5.0	30.0	45.1	3.7	3.7	7.4	1
33.0	15.1	5.0	30.0	57.5	3.7	6.5	10.1	1
34.0	15.3	5.0	30.0	18.5	4.0	1.0	5.1	1
34.0	15.3	5.0	30.0	45.1	4.0	4.3	8.3	1
34.0	15.3	5.0	30.0	57.5	4.0	6.1	10.1	1
52.0	18.1	5.0	30.0	18.5	4.6	2.3	6.9	1
52.0	18.1	5.0	30.0	45.1	4.6	6.9	11.5	1
52.0	18.1	5.0	30.0	57.5	4.6	9.2	13.8	1
65.0	19.6	5.0	30.0	18.5	5.5	1.4	6.9	1
65.0	19.6	5.0	30.0	45.1	5.5	6.0	11.5	1
65.0	19.6	5.0	30.0	57.5	5.5	12.0	17.5	1
67.0	19.8	5.0	30.0	18.5	5.9	4.4	10.2	1
67.0	19.8	5.0	30.0	45.1	5.9	11.6	17.5	1
67.0	19.8	5.0	30.0	57.5	5.9	14.2	20.1	1
86.0	21.5	5.0	30.0	18.5	6.6	4.0	10.6	1
86.0	21.5	5.0	30.0	45.1	6.6	10.4	17.0	1
86.0	21.5	5.0	30.0	57.5	6.6	13.5	20.1	1
96.0	22.2	5.0	30.0	18.5	8.1	3.4	11.5	1
96.0	22.2	5.0	30.0	45.1	8.1	12.2	20.2	1
96.0	22.2	5.0	30.0	57.5	8.1	19.5	27.6	1
109.0	23.1	5.0	30.0	18.5	7.3	4.2	11.5	1
109.0	23.1	5.0	30.0	45.1	7.3	14.8	22.1	1
109.0	23.1	5.0	30.0	57.5	7.3	19.4	26.7	1
121.0	23.8	5.0	30.0	18.5	7.3	6.5	13.8	1
121.0	23.8	5.0	30.0	45.1	7.3	15.2	22.5	1
121.0	23.8	5.0	30.0	57.5	7.3	25.8	33.1	1
135.0	24.5	5.0	30.0	18.5	9.5	5.2	14.7	1
135.0	24.5	5.0	30.0	45.1	9.5	18.1	27.6	1
135.0	24.5	5.0	30.0	57.5	9.5	22.7	32.2	1
140.0	24.7	5.0	30.0	18.5	10.2	4.0	14.3	1
140.0	24.7	5.0	30.0	45.1	10.2	10.9	21.2	1
140.0	24.7	5.0	30.0	57.5	10.2	26.6	36.8	1
190.0	26.8	5.0	30.0	18.5	11.7	8.1	19.8	1
190.0	26.8	5.0	30.0	45.1	11.7	21.4	33.1	1
190.0	26.8	5.0	30.0	57.5	11.7	41.6	53.4	1
196.0	27.0	5.0	30.0	18.5	11.0	8.8	19.8	1
196.0	27.0	5.0	30.0	45.1	11.0	22.1	33.1	1
196.0	27.0	5.0	30.0	57.5	11.0	44.2	55.2	1
23.0	12.7	15.0	30.0	18.5	4.4	3.0	7.4	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
23.0	12.7	15.0	30.0	45.1	4.4	5.7	10.1	1
23.0	12.7	15.0	30.0	72.7	4.4	7.6	12.0	1
30.0	14.5	15.0	30.0	18.5	6.6	1.7	8.3	1
30.0	14.5	15.0	30.0	45.1	6.6	3.5	10.1	1
30.0	14.5	15.0	30.0	72.7	6.6	6.3	12.9	1
36.0	15.7	15.0	30.0	18.5	5.1	5.0	10.1	1
36.0	15.7	15.0	30.0	45.1	5.1	6.8	12.0	1
36.0	15.7	15.0	30.0	72.7	5.1	11.4	16.6	1
41.0	16.6	15.0	30.0	18.5	9.5	2.4	12.0	1
41.0	16.6	15.0	30.0	45.1	9.5	6.1	15.6	1
41.0	16.6	15.0	30.0	72.7	9.5	10.7	20.2	1
47.0	17.5	15.0	30.0	18.5	9.5	2.4	12.0	1
47.0	17.5	15.0	30.0	45.1	9.5	7.0	16.6	1
47.0	17.5	15.0	30.0	72.7	9.5	10.7	20.2	1
52.0	18.1	15.0	30.0	18.5	8.1	4.8	12.9	1
52.0	18.1	15.0	30.0	45.1	8.1	8.5	16.6	1
52.0	18.1	15.0	30.0	72.7	8.1	16.8	24.8	1
57.0	18.8	15.0	30.0	18.5	10.2	4.5	14.7	1
57.0	18.8	15.0	30.0	45.1	10.2	13.7	23.9	1
57.0	18.8	15.0	30.0	72.7	10.2	19.2	29.4	1
80.0	21.0	15.0	30.0	18.5	10.6	5.9	16.6	1
80.0	21.0	15.0	30.0	45.1	10.6	13.3	23.9	1
80.0	21.0	15.0	30.0	72.7	10.6	24.3	35.0	1
87.0	21.6	15.0	30.0	18.5	11.3	7.1	18.4	1
87.0	21.6	15.0	30.0	45.1	11.3	12.6	23.9	1
87.0	21.6	15.0	30.0	72.7	11.3	31.0	42.3	1
93.0	22.0	15.0	30.0	18.5	9.5	8.9	18.4	1
93.0	22.0	15.0	30.0	45.1	9.5	19.9	29.4	1
93.0	22.0	15.0	30.0	72.7	9.5	31.9	41.4	1
95.0	22.2	15.0	30.0	18.5	11.0	8.3	19.3	1
95.0	22.2	15.0	30.0	18.5	12.6	6.7	19.3	1
95.0	22.2	15.0	30.0	45.1	11.0	21.2	32.2	1
95.0	22.2	15.0	30.0	45.1	12.6	19.6	32.2	1
95.0	22.2	15.0	30.0	72.7	11.0	38.2	49.2	1
95.0	22.2	15.0	30.0	72.7	12.6	36.6	49.2	1
101.0	22.6	15.0	30.0	18.5	13.5	3.0	16.6	1
101.0	22.6	15.0	30.0	45.1	13.5	18.7	32.2	1
101.0	22.6	15.0	30.0	72.7	13.5	29.2	42.8	1
102.0	22.6	15.0	30.0	18.5	16.1	2.3	18.4	1
102.0	22.6	15.0	30.0	45.1	16.1	13.3	29.4	1
102.0	22.6	15.0	30.0	72.7	16.1	33.6	49.7	1
104.0	22.8	15.0	30.0	18.5	13.5	5.8	19.3	1
104.0	22.8	15.0	30.0	45.1	13.5	15.9	29.4	1
104.0	22.8	15.0	30.0	72.7	13.5	37.1	50.6	1
111.0	23.2	15.0	30.0	18.5	12.6	6.7	19.3	1
111.0	23.2	15.0	30.0	45.1	12.6	19.6	32.2	1
111.0	23.2	15.0	30.0	72.7	12.6	39.8	52.4	1

Table 7 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
120.0	23.7	15.0	30.0	18.5	13.5	6.7	20.2	1
120.0	23.7	15.0	30.0	18.5	14.6	7.4	22.1	1
120.0	23.7	15.0	30.0	45.1	13.5	23.3	36.8	1
120.0	23.7	15.0	30.0	45.1	14.6	29.5	44.2	1
120.0	23.7	15.0	30.0	72.7	13.5	46.3	59.8	1
120.0	23.7	15.0	30.0	72.7	14.6	48.8	63.5	1
138.0	24.6	15.0	30.0	18.5	15.4	9.5	24.8	1
138.0	24.6	15.0	30.0	45.1	15.4	28.8	44.2	1
138.0	24.6	15.0	30.0	72.7	15.4	44.4	59.8	1

NA: Not Available

‡ Source: 1. Rao (1967); 2. Kicenuk and Jones (1977); 3. Rodgers and Beamish (1981); 4. Morgan and Iwama (1991); 5. Webb (1971); 6. Duthie (1987); 7. Bushnell et al. (1984)

Table 8. Swimming costs and total metabolic rates of coho salmon. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
1.0	4.7	5.0	0.0	7.5	0.13	0.13	0.27	1
1.0	4.7	5.0	0.0	7.5	0.13	0.28	0.41	1
1.0	4.7	5.0	0.0	10.0	0.13	0.20	0.33	1
1.0	4.7	5.0	0.0	10.0	0.13	0.28	0.41	1
1.0	4.7	5.0	0.0	10.0	0.13	0.50	0.63	1
1.0	4.7	5.0	0.0	15.0	0.13	0.38	0.51	1
1.0	4.7	5.0	0.0	15.0	0.13	0.57	0.70	1
8.7	9.4	5.0	0.0	7.5	0.54	0.00	0.54	1
8.7	9.4	5.0	0.0	7.5	0.54	0.16	0.70	1
8.7	9.4	5.0	0.0	7.5	0.54	0.33	0.87	1
8.7	9.4	5.0	0.0	10.0	0.54	0.33	0.87	1
8.7	9.4	5.0	0.0	10.0	0.54	0.54	1.08	1
8.7	9.4	5.0	0.0	15.0	0.54	0.80	1.34	1
8.7	9.4	5.0	0.0	15.0	0.54	1.32	1.86	1
8.7	9.4	5.0	0.0	22.5	0.54	0.66	1.20	1
8.7	9.4	5.0	0.0	22.5	0.54	0.96	1.50	1
8.7	9.4	5.0	0.0	22.5	0.54	1.32	1.86	1
8.7	9.4	5.0	0.0	30.0	0.54	1.13	1.67	1
8.7	9.4	5.0	0.0	30.0	0.54	1.54	2.08	1
8.7	9.4	5.0	0.0	40.0	0.54	2.04	2.58	1
1.0	4.7	8.0	0.0	7.5	0.16	0.06	0.21	1
1.0	4.7	8.0	0.0	7.5	0.16	0.21	0.36	1
1.0	4.7	8.0	0.0	10.0	0.16	0.04	0.19	1
1.0	4.7	8.0	0.0	10.0	0.16	0.17	0.33	1
1.0	4.7	8.0	0.0	10.0	0.16	0.25	0.41	1
1.0	4.7	8.0	0.0	15.0	0.16	0.25	0.41	1
1.0	4.7	8.0	0.0	15.0	0.16	0.35	0.50	1
1.0	4.7	8.0	0.0	22.5	0.16	0.62	0.78	1
2.5	6.3	8.0	0.0	7.5	0.37	0.51	0.87	1
2.5	6.3	8.0	0.0	7.5	0.37	0.83	1.20	1
2.5	6.3	8.0	0.0	10.0	0.37	0.42	0.79	1
2.5	6.3	8.0	0.0	10.0	0.37	0.60	0.97	1
2.5	6.3	8.0	0.0	22.5	0.37	0.42	0.79	1
2.5	6.3	8.0	0.0	22.5	0.37	1.29	1.66	1
2.5	6.3	8.0	0.0	32.5	0.37	2.77	3.14	1
2.5	6.3	8.0	0.0	32.5	0.37	3.51	3.88	1
5.9	8.4	8.0	0.0	10.0	0.71	0.20	0.90	1
5.9	8.4	8.0	0.0	10.0	0.71	0.30	1.01	1
5.9	8.4	8.0	0.0	10.0	0.71	0.54	1.24	1
5.9	8.4	8.0	0.0	10.0	0.71	0.83	1.54	1
5.9	8.4	8.0	0.0	22.0	0.71	0.41	1.12	1
5.9	8.4	8.0	0.0	22.0	0.71	0.68	1.38	1
5.9	8.4	8.0	0.0	22.0	0.71	1.00	1.71	1

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
5.9	8.4	8.0	0.0	30.0	0.71	0.54	1.24	1
5.9	8.4	8.0	0.0	30.0	0.71	0.83	1.54	1
5.9	8.4	8.0	0.0	30.0	0.71	1.20	1.90	1
5.9	8.4	8.0	0.0	35.0	0.71	0.68	1.38	1
5.9	8.4	8.0	0.0	35.0	0.71	1.00	1.71	1
5.9	8.4	8.0	0.0	35.0	0.71	1.65	2.36	1
8.7	9.4	8.0	0.0	7.5	0.59	0.32	0.91	1
8.7	9.4	8.0	0.0	7.5	0.59	0.67	1.26	1
8.7	9.4	8.0	0.0	10.0	0.59	0.32	0.91	1
8.7	9.4	8.0	0.0	10.0	0.59	0.54	1.13	1
8.7	9.4	8.0	0.0	22.5	0.59	0.82	1.41	1
8.7	9.4	8.0	0.0	22.5	0.59	1.17	1.76	1
8.7	9.4	8.0	0.0	30.0	0.59	1.37	1.96	1
8.7	9.4	8.0	0.0	30.0	0.59	1.60	2.19	1
8.7	9.4	8.0	0.0	30.0	0.59	2.14	2.73	1
8.7	9.4	8.0	0.0	40.0	0.59	2.81	3.40	1
1.0	4.7	11.0	0.0	7.5	0.22	0.29	0.51	1
1.0	4.7	11.0	0.0	7.5	0.22	0.66	0.88	1
1.0	4.7	11.0	0.0	7.5	0.22	1.01	1.23	1
1.0	4.7	11.0	0.0	10.0	0.22	0.29	0.51	1
1.0	4.7	11.0	0.0	10.0	0.22	0.57	0.79	1
1.0	4.7	11.0	0.0	10.0	0.22	0.88	1.10	1
1.0	4.7	11.0	0.0	15.0	0.22	0.49	0.71	1
1.0	4.7	11.0	0.0	15.0	0.22	0.57	0.79	1
1.0	4.7	11.0	0.0	15.0	0.22	0.66	0.88	1
1.0	4.7	11.0	0.0	22.5	0.22	1.31	1.53	1
2.5	6.3	11.0	0.0	7.5	0.43	0.36	0.79	1
2.5	6.3	11.0	0.0	7.5	0.43	0.55	0.98	1
2.5	6.3	11.0	0.0	10.0	0.43	0.28	0.71	1
2.5	6.3	11.0	0.0	10.0	0.43	0.55	0.98	1
2.5	6.3	11.0	0.0	22.5	0.43	0.78	1.21	1
2.5	6.3	11.0	0.0	32.5	0.43	1.63	2.06	1
2.5	6.3	11.0	0.0	35.0	0.43	2.12	2.55	1
2.5	6.3	11.0	0.0	35.0	0.43	3.47	3.90	1
3.5	7.0	11.0	0.0	10.0	0.56	0.43	1.00	1
3.5	7.0	11.0	0.0	10.0	0.56	0.81	1.37	1
3.5	7.0	11.0	0.0	10.0	0.56	1.33	1.89	1
3.5	7.0	11.0	0.0	12.5	0.56	0.33	0.90	1
3.5	7.0	11.0	0.0	12.5	0.56	1.54	2.10	1
3.5	7.0	11.0	0.0	22.5	0.56	0.55	1.11	1
3.5	7.0	11.0	0.0	22.5	0.56	1.33	1.89	1
3.5	7.0	11.0	0.0	32.5	0.56	1.14	1.70	1
3.5	7.0	11.0	0.0	32.5	0.56	1.54	2.10	1
5.9	8.4	11.0	0.0	10.0	0.78	0.23	1.01	1
5.9	8.4	11.0	0.0	10.0	0.78	0.47	1.25	1
5.9	8.4	11.0	0.0	10.0	0.78	0.61	1.39	1
5.9	8.4	11.0	0.0	22.0	0.78	0.34	1.12	1

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
5.9	8.4	11.0	0.0	22.0	0.78	0.77	1.55	1
5.9	8.4	11.0	0.0	30.0	0.78	0.94	1.72	1
5.9	8.4	11.0	0.0	30.0	0.78	1.35	2.13	1
5.9	8.4	11.0	0.0	30.0	0.78	2.48	3.26	1
5.9	8.4	11.0	0.0	35.0	0.78	1.13	1.91	1
5.9	8.4	11.0	0.0	35.0	0.78	1.85	2.64	1
5.9	8.4	11.0	0.0	35.0	0.78	2.15	2.93	1
8.7	9.4	11.0	0.0	7.5	0.75	0.56	1.31	1
8.7	9.4	11.0	0.0	7.5	0.75	0.88	1.63	1
8.7	9.4	11.0	0.0	10.0	0.75	0.71	1.47	1
8.7	9.4	11.0	0.0	10.0	0.75	1.07	1.82	1
8.7	9.4	11.0	0.0	10.0	0.75	1.28	2.03	1
8.7	9.4	11.0	0.0	22.5	0.75	1.07	1.82	1
8.7	9.4	11.0	0.0	30.0	0.75	1.51	2.27	1
8.7	9.4	11.0	0.0	30.0	0.75	2.06	2.82	1
1.0	4.7	14.0	0.0	7.5	0.27	0.04	0.31	1
1.0	4.7	14.0	0.0	7.5	0.27	0.27	0.54	1
1.0	4.7	14.0	0.0	7.5	0.27	0.49	0.76	1
1.0	4.7	14.0	0.0	10.0	0.27	0.41	0.68	1
1.0	4.7	14.0	0.0	10.0	0.27	0.58	0.84	1
1.0	4.7	14.0	0.0	10.0	0.27	0.78	1.05	1
1.0	4.7	14.0	0.0	15.0	0.27	0.67	0.94	1
1.0	4.7	14.0	0.0	15.0	0.27	1.04	1.31	1
1.0	4.7	14.0	0.0	22.5	0.27	0.91	1.17	1
2.5	6.3	14.0	0.0	7.5	0.59	0.68	1.27	1
2.5	6.3	14.0	0.0	7.5	0.59	1.00	1.58	1
2.5	6.3	14.0	0.0	10.0	0.59	0.32	0.91	1
2.5	6.3	14.0	0.0	10.0	0.59	0.68	1.27	1
2.5	6.3	14.0	0.0	22.5	0.59	1.00	1.58	1
2.5	6.3	14.0	0.0	22.5	0.59	1.39	1.97	1
2.5	6.3	14.0	0.0	32.5	0.59	1.88	2.46	1
2.5	6.3	14.0	0.0	37.5	0.59	2.48	3.07	1
2.5	6.3	14.0	0.0	37.5	0.59	2.84	3.43	1
3.5	7.0	14.0	0.0	10.0	0.74	0.51	1.25	1
3.5	7.0	14.0	0.0	10.0	0.74	1.17	1.91	1
3.5	7.0	14.0	0.0	10.0	0.74	1.63	2.36	1
3.5	7.0	14.0	0.0	12.5	0.74	0.98	1.72	1
3.5	7.0	14.0	0.0	22.5	0.74	0.51	1.25	1
3.5	7.0	14.0	0.0	22.5	0.74	0.98	1.72	1
3.5	7.0	14.0	0.0	32.5	0.74	1.17	1.91	1
3.5	7.0	14.0	0.0	32.5	0.74	2.19	2.93	1
5.9	8.4	14.0	0.0	10.0	0.95	0.32	1.27	1
5.9	8.4	14.0	0.0	10.0	0.95	0.64	1.59	1
5.9	8.4	14.0	0.0	22.0	0.95	0.64	1.59	1
5.9	8.4	14.0	0.0	30.0	0.95	1.03	1.98	1
5.9	8.4	14.0	0.0	30.0	0.95	1.52	2.47	1
5.9	8.4	14.0	0.0	30.0	0.95	2.13	3.08	1

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
5.9	8.4	14.0	0.0	35.0	0.95	1.03	1.98	1
5.9	8.4	14.0	0.0	35.0	0.95	1.52	2.47	1
5.9	8.4	14.0	0.0	35.0	0.95	2.13	3.08	1
5.9	8.4	14.0	0.0	35.0	0.95	2.89	3.84	1
8.7	9.4	14.0	0.0	10.0	1.04	0.70	1.74	1
8.7	9.4	14.0	0.0	10.0	1.04	1.13	2.17	1
8.7	9.4	14.0	0.0	10.0	1.04	3.17	4.21	1
8.7	9.4	14.0	0.0	12.5	1.04	1.13	2.17	1
8.7	9.4	14.0	0.0	12.5	1.04	1.67	2.70	1
8.7	9.4	14.0	0.0	22.5	1.04	1.67	2.70	1
8.7	9.4	14.0	0.0	22.5	1.04	2.34	3.37	1
8.7	9.4	14.0	0.0	30.0	1.04	2.73	3.77	1
1.0	4.7	17.0	0.0	7.5	0.32	0.31	0.63	1
1.0	4.7	17.0	0.0	7.5	0.32	0.46	0.78	1
1.0	4.7	17.0	0.0	7.5	0.32	0.55	0.87	1
1.0	4.7	17.0	0.0	10.0	0.32	0.55	0.87	1
1.0	4.7	17.0	0.0	10.0	0.32	0.88	1.20	1
1.0	4.7	17.0	0.0	10.0	0.32	1.17	1.48	1
1.0	4.7	17.0	0.0	15.0	0.32	0.65	0.97	1
1.0	4.7	17.0	0.0	15.0	0.32	0.88	1.20	1
1.0	4.7	17.0	0.0	22.5	0.32	1.33	1.65	1
2.5	6.3	17.0	0.0	7.5	0.74	0.39	1.13	1
2.5	6.3	17.0	0.0	7.5	0.74	1.02	1.76	1
2.5	6.3	17.0	0.0	10.0	0.74	0.67	1.41	1
2.5	6.3	17.0	0.0	22.5	0.74	1.71	2.45	1
2.5	6.3	17.0	0.0	22.5	0.74	2.67	3.41	1
2.5	6.3	17.0	0.0	32.5	0.74	2.67	3.41	1
2.5	6.3	17.0	0.0	32.5	0.74	3.52	4.26	1
3.5	7.0	17.0	0.0	7.5	0.98	0.46	1.45	1
3.5	7.0	17.0	0.0	7.5	0.98	0.82	1.80	1
3.5	7.0	17.0	0.0	10.0	0.98	0.46	1.45	1
3.5	7.0	17.0	0.0	10.0	0.98	1.26	2.25	1
3.5	7.0	17.0	0.0	10.0	0.98	1.82	2.80	1
3.5	7.0	17.0	0.0	22.5	0.98	1.03	2.01	1
3.5	7.0	17.0	0.0	22.5	0.98	1.53	2.51	1
3.5	7.0	17.0	0.0	35.0	0.98	1.53	2.51	1
3.5	7.0	17.0	0.0	35.0	0.98	2.15	3.13	1
3.5	7.0	17.0	0.0	35.0	0.98	2.92	3.91	1
5.9	8.4	17.0	0.0	10.0	1.16	0.11	1.26	1
5.9	8.4	17.0	0.0	10.0	1.16	0.42	1.58	1
5.9	8.4	17.0	0.0	22.0	1.16	0.81	1.97	1
5.9	8.4	17.0	0.0	22.0	1.16	1.30	2.45	1
5.9	8.4	17.0	0.0	30.0	1.16	1.59	2.74	1
5.9	8.4	17.0	0.0	30.0	1.16	2.26	3.42	1
5.9	8.4	17.0	0.0	30.0	1.16	3.11	4.26	1
5.9	8.4	17.0	0.0	35.0	1.16	1.30	2.45	1
5.9	8.4	17.0	0.0	35.0	1.16	1.91	3.06	1

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
5.9	8.4	17.0	0.0	35.0	1.16	3.11	4.26	1
8.7	9.4	17.0	0.0	7.5	1.30	0.71	2.00	1
8.7	9.4	17.0	0.0	7.5	1.30	1.19	2.49	1
8.7	9.4	17.0	0.0	10.0	1.30	0.94	2.23	1
8.7	9.4	17.0	0.0	10.0	1.30	1.19	2.49	1
8.7	9.4	17.0	0.0	22.5	1.30	1.19	2.49	1
8.7	9.4	17.0	0.0	22.5	1.30	1.80	3.10	1
8.7	9.4	17.0	0.0	22.5	1.30	2.56	3.85	1
8.7	9.4	17.0	0.0	30.0	1.30	1.80	3.10	1
8.7	9.4	17.0	0.0	30.0	1.30	2.56	3.85	1
8.7	9.4	17.0	0.0	30.0	1.30	3.00	4.29	1
8.7	9.4	17.0	0.0	40.0	1.30	3.49	4.79	1
2.5	6.3	20.0	0.0	7.5	0.96	0.41	1.37	1
2.5	6.3	20.0	0.0	7.5	0.96	1.63	2.59	1
2.5	6.3	20.0	0.0	10.0	0.96	0.41	1.37	1
2.5	6.3	20.0	0.0	10.0	0.96	0.92	1.88	1
2.5	6.3	20.0	0.0	22.5	0.96	0.92	1.88	1
2.5	6.3	20.0	0.0	22.5	0.96	1.92	2.88	1
2.5	6.3	20.0	0.0	32.5	0.96	1.63	2.59	1
2.5	6.3	20.0	0.0	32.5	0.96	2.25	3.21	1
3.5	7.0	20.0	0.0	10.0	1.18	0.26	1.44	1
3.5	7.0	20.0	0.0	10.0	1.18	1.06	2.24	1
3.5	7.0	20.0	0.0	10.0	1.18	3.67	4.85	1
3.5	7.0	20.0	0.0	12.5	1.18	0.83	2.00	1
3.5	7.0	20.0	0.0	12.5	1.18	1.32	2.50	1
3.5	7.0	20.0	0.0	22.5	1.18	1.06	2.24	1
3.5	7.0	20.0	0.0	22.5	1.18	1.32	2.50	1
3.5	7.0	20.0	0.0	32.5	1.18	1.94	3.12	1
3.5	7.0	20.0	0.0	32.5	1.18	2.30	3.48	1
5.9	8.4	20.0	0.0	10.0	1.38	0.57	1.95	1
5.9	8.4	20.0	0.0	10.0	1.38	0.79	2.17	1
5.9	8.4	20.0	0.0	10.0	1.38	1.30	2.68	1
5.9	8.4	20.0	0.0	22.0	1.38	0.19	1.57	1
5.9	8.4	20.0	0.0	22.0	1.38	1.30	2.68	1
5.9	8.4	20.0	0.0	22.0	1.38	4.27	5.65	1
5.9	8.4	20.0	0.0	30.0	1.38	1.60	2.98	1
5.9	8.4	20.0	0.0	30.0	1.38	2.31	3.69	1
5.9	8.4	20.0	0.0	35.0	1.38	1.94	3.32	1
5.9	8.4	20.0	0.0	35.0	1.38	3.19	4.57	1
3.5	7.0	23.0	0.0	10.0	1.44	1.54	2.98	1
3.5	7.0	23.0	0.0	10.0	1.44	2.24	3.68	1
3.5	7.0	23.0	0.0	12.5	1.44	0.50	1.94	1
3.5	7.0	23.0	0.0	12.5	1.44	0.97	2.40	1
3.5	7.0	23.0	0.0	12.5	1.44	1.87	3.31	1
3.5	7.0	23.0	0.0	22.5	1.44	1.54	2.98	1
3.5	7.0	23.0	0.0	22.5	1.44	2.24	3.68	1
3.5	7.0	23.0	0.0	32.5	1.44	1.54	2.98	1

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
3.5	7.0	23.0	0.0	32.5	1.44	2.66	4.10	1
0.9	4.4	15.0	0.0	10.1	0.13	0.14	0.27	2
0.9	4.4	15.0	0.0	11.9	0.13	0.20	0.32	2
0.9	4.4	15.0	0.0	15.0	0.13	0.28	0.41	2
0.9	4.4	15.0	0.0	17.6	0.13	0.37	0.50	2
1.0	5.0	15.0	0.0	7.5	0.30	0.11	0.41	2
1.0	4.7	15.0	0.0	8.5	0.18	0.15	0.33	2
1.0	5.0	15.0	0.0	8.5	0.30	0.06	0.36	2
1.0	4.7	15.0	0.0	9.4	0.18	0.21	0.39	2
1.0	5.0	15.0	0.0	10.5	0.30	0.34	0.64	2
1.0	5.0	15.0	0.0	12.5	0.30	0.23	0.53	2
1.0	5.0	15.0	0.0	13.0	0.30	0.13	0.43	2
1.0	4.7	15.0	0.0	15.0	0.18	0.29	0.47	2
1.0	4.7	15.0	0.0	18.8	0.18	0.40	0.58	2
1.0	5.0	15.0	0.0	19.0	0.30	0.35	0.65	2
1.0	4.7	15.0	0.0	19.7	0.18	0.53	0.71	2
1.0	4.7	15.0	0.0	21.6	0.18	0.61	0.79	2
1.0	4.7	15.0	0.0	21.6	0.18	0.61	0.79	2
1.0	4.7	15.0	0.0	21.6	0.18	0.95	1.13	2
1.1	4.8	15.0	0.0	7.7	0.20	0.12	0.32	2
1.1	4.9	15.0	0.0	8.3	0.14	0.19	0.33	2
1.1	4.9	15.0	0.0	9.3	0.14	0.10	0.24	2
1.1	4.7	15.0	0.0	10.3	0.07	0.13	0.20	2
1.1	4.7	15.0	0.0	12.2	0.07	0.20	0.26	2
1.1	4.8	15.0	0.0	12.5	0.20	0.14	0.34	2
1.1	4.8	15.0	0.0	12.5	0.20	0.13	0.33	2
1.1	4.9	15.0	0.0	12.7	0.14	0.13	0.28	2
1.1	4.7	15.0	0.0	14.1	0.07	0.26	0.33	2
1.1	4.7	15.0	0.0	15.0	0.07	0.18	0.24	2
1.1	4.7	15.0	0.0	16.0	0.07	0.31	0.37	2
1.1	4.9	15.0	0.0	16.2	0.14	0.32	0.46	2
1.1	4.9	15.0	0.0	17.2	0.14	0.40	0.54	2
1.1	4.8	15.0	0.0	18.7	0.20	0.21	0.41	2
1.1	4.7	15.0	0.0	18.8	0.07	0.42	0.48	2
1.1	4.7	15.0	0.0	18.8	0.07	0.45	0.52	2
1.1	4.8	15.0	0.0	19.7	0.20	0.45	0.65	2
1.2	4.7	15.0	0.0	6.6	0.19	0.06	0.25	2
1.2	4.7	15.0	0.0	6.6	0.19	0.21	0.40	2
1.2	4.9	15.0	0.0	7.4	0.18	0.05	0.23	2
1.2	4.9	15.0	0.0	7.4	0.18	0.07	0.25	2
1.2	5.0	15.0	0.0	8.5	0.28	0.17	0.44	2
1.2	4.9	15.0	0.0	10.3	0.18	0.27	0.46	2
1.2	4.7	15.0	0.0	10.3	0.19	0.09	0.28	2
1.2	5.0	15.0	0.0	11.5	0.22	0.33	0.55	2
1.2	5.0	15.0	0.0	13.0	0.22	0.43	0.65	2
1.2	5.0	15.0	0.0	13.0	0.28	0.34	0.61	2
1.2	5.0	15.0	0.0	13.0	0.28	0.25	0.53	2

Table 8 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
1.2	4.7	15.0	0.0	13.2	0.19	0.31	0.50	2
1.2	4.7	15.0	0.0	14.1	0.19	0.29	0.48	2
1.2	4.7	15.0	0.0	16.0	0.19	0.45	0.64	2
1.2	4.9	15.0	0.0	17.2	0.18	0.32	0.50	2
1.2	5.0	15.0	0.0	18.0	0.22	0.38	0.60	2
1.2	4.7	15.0	0.0	19.7	0.19	0.46	0.65	2
1.2	4.9	15.0	0.0	23.5	0.18	0.50	0.68	2
1.3	5.0	15.0	0.0	4.0	0.16	0.05	0.21	2
1.3	5.0	15.0	0.0	4.0	0.16	0.04	0.20	2
1.3	5.0	15.0	0.0	6.5	0.16	0.14	0.30	2
1.3	5.0	15.0	0.0	7.5	0.16	0.14	0.30	2
1.3	5.0	15.0	0.0	7.5	0.21	0.12	0.33	2
1.3	5.0	15.0	0.0	9.5	0.10	0.09	0.20	2
1.3	5.0	15.0	0.0	9.5	0.21	0.11	0.31	2
1.3	5.0	15.0	0.0	10.5	0.16	0.17	0.33	2
1.3	5.0	15.0	0.0	13.0	0.21	0.15	0.35	2
1.3	5.0	15.0	0.0	14.0	0.16	0.39	0.55	2
1.3	5.0	15.0	0.0	14.0	0.10	0.17	0.27	2
1.3	5.0	15.0	0.0	16.0	0.10	0.20	0.30	2
1.3	5.0	15.0	0.0	16.0	0.21	0.33	0.53	2
1.3	5.0	15.0	0.0	17.0	0.21	0.33	0.53	2
1.3	5.0	15.0	0.0	18.0	0.16	0.52	0.68	2
1.3	5.0	15.0	0.0	18.0	0.16	0.34	0.49	2
1.3	5.0	15.0	0.0	21.0	0.21	0.38	0.59	2
1.3	5.0	15.0	0.0	23.5	0.10	0.38	0.48	2
1.4	5.0	15.0	0.0	8.5	0.29	0.23	0.52	2
1.4	5.0	15.0	0.0	9.5	0.29	0.17	0.46	2
1.4	5.0	15.0	0.0	11.5	0.29	0.20	0.49	2
1.4	5.0	15.0	0.0	14.0	0.29	0.24	0.53	2
1.4	5.0	15.0	0.0	15.0	0.29	0.24	0.53	2
1.4	5.0	15.0	0.0	17.0	0.29	0.25	0.55	2
1.4	5.0	15.0	0.0	17.0	0.29	0.58	0.87	2
1.4	5.0	15.0	0.0	17.0	0.29	0.49	0.78	2
1.4	5.0	15.0	0.0	20.0	0.29	0.51	0.80	2

‡ Source: 1. Averett (1969); 2. Puckett (1983)

Table 9. Swimming costs and total metabolic rates of chinook salmon. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
8.0	9.1	11.5	0.0	9.1	NA	NA	2.12	1
6.9	8.7	11.5	5.0	8.7	NA	NA	2.08	1
6.3	8.4	11.5	10.0	8.4	NA	NA	1.97	1
5.5	8.0	11.5	20.0	8.0	NA	NA	1.97	1
4.4	7.3	11.5	28.0	7.3	NA	NA	1.56	1
365.0	32.0	9.0	0.0	9.7	32.0	15.5	47.5	2
365.0	32.0	9.0	0.0	27.8	32.0	22.8	54.8	2
365.0	32.0	9.0	0.0	41.0	32.0	30.1	62.1	2
365.0	32.0	9.0	0.0	50.0	32.0	54.9	86.9	2
365.0	32.0	9.0	0.0	59.9	32.0	84.1	116.1	2
365.0	32.0	9.0	0.0	68.8	32.0	110.4	142.4	2
365.0	32.0	9.0	0.0	75.0	32.0	139.6	171.6	2
365.0	32.0	9.0	0.0	79.0	32.0	150.5	182.5	2
365.0	32.0	9.0	0.0	84.0	32.0	161.5	193.5	2
365.0	32.0	9.0	0.0	88.2	32.0	183.4	215.4	2
362.5	32.0	9.0	0.0	9.0	37.1	17.7	54.8	2
362.5	32.0	9.0	0.0	27.1	37.1	28.6	65.7	2
362.5	32.0	9.0	0.0	38.9	37.1	39.6	76.7	2
362.5	32.0	9.0	0.0	47.9	37.1	49.8	86.9	2
362.5	32.0	9.0	0.0	58.3	37.1	76.1	113.2	2
362.5	32.0	9.0	0.0	65.3	37.1	108.9	146.0	2
362.5	32.0	9.0	0.0	71.4	37.1	160.0	197.1	2
362.5	32.0	9.0	0.0	77.1	37.1	160.0	197.1	2
362.5	32.0	9.0	0.0	81.9	37.1	181.9	219.0	2
362.5	32.0	9.0	0.0	87.5	37.1	214.8	251.9	2
362.5	32.0	9.0	0.0	93.1	37.1	251.3	288.4	2

NA: Not Available

‡ Source: 1. Morgan and Iwama (1991); 2. Gallaugher et al. (2001)

Table10. Swimming costs and total metabolic rates of masu salmon. W: Mass; TL: Total length; T: Water temperature; S: Salinity; U: Swimming speed; R_s: Standard metabolic rates; R_a: swimming costs; R_T: total metabolic rates.

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source‡
210.5	29.0	12.0	0.0	47.0	16.1	--	7.9	1
210.5	29.0	12.0	0.0	44.4	16.1	--	15.2	1
210.5	29.0	12.0	0.0	45.0	16.1	3.7	19.8	1
210.5	29.0	12.0	0.0	44.0	16.1	6.5	22.6	1
210.5	29.0	12.0	0.0	44.4	16.1	8.5	24.6	1
210.5	29.0	12.0	0.0	44.9	16.1	30.7	46.8	1
210.5	29.0	12.0	0.0	42.9	16.1	38.2	54.3	1
210.5	29.0	12.0	0.0	48.2	16.1	18.7	34.8	1
210.5	29.0	12.0	0.0	48.8	16.1	18.7	34.8	1
210.5	29.0	12.0	0.0	65.4	16.1	8.9	25.0	1
210.5	29.0	12.0	0.0	64.2	16.1	11.9	28.0	1
210.5	29.0	12.0	0.0	59.4	16.1	18.7	34.8	1
210.5	29.0	12.0	0.0	60.2	16.1	23.6	39.7	1
210.5	29.0	12.0	0.0	59.6	16.1	26.3	42.4	1
210.5	29.0	12.0	0.0	56.9	16.1	35.5	51.6	1
210.5	29.0	12.0	0.0	62.7	16.1	35.5	51.6	1
210.5	29.0	12.0	0.0	59.4	16.1	90.6	106.7	1
210.5	29.0	12.0	0.0	58.6	16.1	101.7	117.8	1
210.5	29.0	12.0	0.0	67.5	16.1	87.2	103.3	1
210.5	29.0	12.0	0.0	71.1	16.1	37.3	53.4	1
210.5	29.0	12.0	0.0	74.1	16.1	24.9	41.0	1
210.5	29.0	12.0	0.0	74.1	16.1	29.2	45.3	1
210.5	29.0	12.0	0.0	74.6	16.1	41.9	58.0	1
210.5	29.0	12.0	0.0	68.5	16.1	18.1	34.2	1
210.5	29.0	12.0	0.0	81.4	16.1	20.4	36.5	1
210.5	29.0	12.0	0.0	73.1	16.1	59.4	75.5	1
210.5	29.0	12.0	0.0	75.3	16.1	103.7	119.8	1
210.5	29.0	12.0	0.0	78.1	16.1	177.2	193.3	1
210.5	29.0	18.0	0.0	48.3	29.6	--	29.5	1
210.5	29.0	18.0	0.0	45.4	29.6	8.8	38.4	1
210.5	29.0	18.0	0.0	44.0	29.6	15.7	45.3	1
210.5	29.0	18.0	0.0	44.4	29.6	21.2	50.8	1
210.5	29.0	18.0	0.0	40.7	29.6	24.7	54.3	1
210.5	29.0	18.0	0.0	40.7	29.6	31.3	60.9	1
210.5	29.0	18.0	0.0	45.5	29.6	55.1	84.7	1
210.5	29.0	18.0	0.0	42.2	29.6	82.5	112.1	1
210.5	29.0	18.0	0.0	45.5	29.6	123.8	153.4	1
210.5	29.0	18.0	0.0	54.3	29.6	33.3	62.9	1
210.5	29.0	18.0	0.0	54.1	29.6	67.1	96.7	1
210.5	29.0	18.0	0.0	60.2	29.6	--	28.0	1
210.5	29.0	18.0	0.0	58.7	29.6	6.3	35.9	1
210.5	29.0	18.0	0.0	59.2	29.6	25.6	55.2	1
210.5	29.0	18.0	0.0	57.6	29.6	33.3	62.9	1

Table 10 (continued)

W (g)	TL (cm)	T (°C)	S (‰)	U (cm/s)	R_s (mg O_2/h)	R_a (mg O_2/h)	R_T (mg O_2/h)	Source
210.5	29.0	18.0	0.0	54.3	29.6	67.1	96.7	1
210.5	29.0	18.0	0.0	56.3	29.6	123.8	153.4	1
210.5	29.0	18.0	0.0	60.7	29.6	63.9	93.5	1
210.5	29.0	18.0	0.0	60.7	29.6	139.8	169.4	1
210.5	29.0	18.0	0.0	64.5	29.6	73.7	103.3	1
210.5	29.0	18.0	0.0	67.5	29.6	118.9	148.5	1
210.5	29.0	18.0	0.0	70.2	29.6	183.8	213.4	1
210.5	29.0	18.0	0.0	80.4	29.6	12.8	42.4	1
210.5	29.0	18.0	0.0	73.1	29.6	55.1	84.7	1
210.5	29.0	18.0	0.0	75.3	29.6	60.9	90.5	1
210.5	29.0	18.0	0.0	73.8	29.6	82.5	112.1	1
210.5	29.0	18.0	0.0	75.8	29.6	107.1	136.7	1
210.5	29.0	18.0	0.0	75.8	29.6	116.4	146.0	1

‡ Source: 1. Leonard et al. (2000)

Table11. Summary statistics of the standard metabolic rates (R_s), swimming costs (R_a), and total metabolic costs (R_T) of sockeye salmon, pink salmon, coho salmon, chinook salmon, masu salmon, and steelhead trout extracted from the literature.

Variable	Sockeye	Pink	Coho	Chinook	Masu	Steelhead
Mass (g)						
Minimum	1.1	1138.0	1.0	4.4	210.5	3.9
Maximum	2232.4	2513.0	8.7	365.0	210.5	1200.0
Temperature (°C)						
Minimum	2.0	15.0	5.0	9.0	12.0	5.0
Maximum	24.0	15.0	23.0	11.5	12.0	20.0
Salinity (‰)						
Minimum	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	28.0	0.0	30.0
Speed (cm/s)						
Minimum	12.8	44.9	3.9	7.3	40.7	5.2
Maximum	178.0	148.2	40.0	93.1	81.4	84.7
R_s (mg O_2/h)						
Minimum	0.2	89.1	0.13	32.0	16.1	0.7
Maximum	187.9	251.8	1.44	37.1	29.6	42.9
R_a (mg O_2/h)						
Minimum	0.3	29.2	0.02	15.5	3.7	0.2
Maximum	1439.1	844.9	4.27	251.3	183.8	450.9
R_T (mg O_2/h)						
Minimum	0.9	196.9	0.18	1.6	7.9	0.5
Maximum	1627.0	1003.1	5.65	288.4	213.4	493.8